

JPRS-TND-89-007
10 APRIL 1989



JPRS Report

Nuclear Developments

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SOUTH AFRICA

Commentary Stresses High Technology Development

MB2303062889 Johannesburg Domestic Service
in English 0500 GMT 23 Mar 89

[Station commentary]

[Text] The most common political division of the world is that between north and south; between the haves of the developed world and the have nots of predominantly the Third World. As the world approaches the 21st century, a more profound division is likely to emerge; that between a small group of nations in the premier technological league, the hi-tech league, and those who have been left behind in the continually accelerating technological race.

South Africa has in many respects been up with the leaders in the technological race. Our oil-from-coal and uranium enrichment technology is evidence of this, as are our skills in a range of activities from shaft sinking and deep level mining to participation in major hydro-electric projects, of which the Lesotho highlands water project is the latest. The high level of South African technological skill, initiative, and entrepreneurship is to be seen in a wide variety of fields from the development of a major iron and steel industry, and an extensive electricity and communications infrastructure, to the present ambitious Mosgas project. In other areas such as the computerization revolution, South Africa still has to catch up with those in the premier league.

For South Africa, full and active membership of the hi-tech league of the 21st century is the key to economic development on the substantial scale needed to achieve optimal human advancement. It is also the passport to greater international recognition. For example, South

Africa has in the recent past established herself as the regional power in southern Africa. She did so not because of any desire by her neighbors for friendship or political accommodation, but because of the respect South Africa commanded by virtue of the far superior technological capability of, among others, the defense force, Eskom, and South African transport services.

The political clout and respect that results from technological muscle is to be seen in a wider international sense as well. This week the Dutch government asked the EEC to reduce nuclear technology sanctions against South Africa in return for South Africa signing the nuclear nonproliferation treaty. In fact South Africa has already indicated that she will sign the treaty if guarantees are given that political considerations will not intrude in the strictly technical matter. The new Dutch move on this issue and the willingness to soften sanctions on nuclear technology underline the political importance of a country that can boast advanced technological capability. Full utilization of South Africa's potential in the world's hi-tech league is dependent as well on human skills advancement in the large Third World component in our society.

Development projects including those dealing with education and training must continue to be a priority. In this regard technological acceleration must not be seen as contradictory to the need for labor-intensive work places. Experiences, in the Far East have shown that hi-tech can create jobs and new industries, and can stimulate informal sector growth.

What is important is that while development projects continue to be emphasized, sectors of the economy that can contribute to hi-tech growth be kept virile and expanding in order to equip South Africa for the technological demands and challenges of the 21st century.

Foreign Ministry Denies Iran Arms Deal
OW3003111989 Beijing XINHUA in English
1058 GMT 30 Mar 89

[Text] The report on the deal of a large amount of weapons between China and Iran is groundless, a Chinese Foreign Ministry spokesman said here today.

The spokesman made the remark in response to correspondents' request to confirm the report in a foreign journal.

The spokesman said, "China has all along adopted a prudent and responsible attitude towards the issue of arms sales. Under the circumstances that no armistice has been realized between Iran and Iraq, China will not do anything to the detriment of a reconciliation between Iran and Iraq."

Energy Minister Discusses Nuclear Power Plans
OW2803073889 Beijing XINHUA in English
1433 GMT 27 Mar 89

[Text] Construction of more nuclear power plants is the only way out for an energy-hungry China, Minister of Energy Huang Yicheng said here today.

Huang made the remark at a group discussion by deputies to the Seventh National People's Congress (NPC) now in session here.

Much of China's power supply comes from thermal power plants, but increase of coal production has its limits and the country's overstrained transport system cannot guarantee shipment of enough coal for increasing numbers of thermal power plants, the minister said.

"Prospects for developing nuclear-generated electricity are bright so long as we construct numerous nuclear power plants simultaneously to reduce their construction cost to within 150 percent of that for thermal power plants," he said.

Two nuclear plants are being built in China. One is in Daya Bay, Guangdong Province, with a generating capacity of 900,000 kw; and the other is located in Qingshan of Zhejiang Province with a generating capacity of 600,000 kw.

The Soviet Union, he said, has expressed willingness to sell nuclear plant equipment to China.

China has asked Sweden to do feasibility studies on building a maximum-safety nuclear reactor of 600,000 kw in the country.

Asked how to dispose of nuclear wastes, the minister said that they can be treated and buried in the heart of China's vast uninhabited deserts.

Daya Bay Considered for Second Power Station
51004002 Hong Kong STANDARD in English
20 Feb 89 p 1

[Article by Yau Shing-mu and Denise Wong]

[Text] China may build a second nuclear power station almost next door to the controversial Daya Bay plant.

Daya Bay is one of two sites on the Guangdong coast under consideration for a new power station, the official English-language CHINA DAILY reported yesterday.

China is known to be planning two more nuclear power stations in Guangdong, but there had been no indication until now of where they might be built.

Hongkong's anti-nuclear-power campaigners said last night that another plant at Daya Bay would double the potential danger and add one more worry for Hongkong people in the 21st century.

The CHINA DAILY said a proposal had been put forward to build the plant on one of two sites on the Guangdong coast.

It did not specify the exact location of the sites, but said one was in Daya Bay, close to where the province's first nuclear plant is under construction using French and British technology and equipment.

The paper gave no indication of when a firm decision would be made or when the plant would be built, but disclosed that a feasibility study is under way.

It said construction would not begin until authorities in Beijing approved the plan.

The newspaper quoted Mr Liang Hanzhao, deputy manager of the Guangdong Nuclear Power Company—a joint venture partner in the Daya Bay plant—as saying nuclear facilities now planned would not be enough to overcome the province's power shortage.

Guangdong's power generation capacity is 6,100 megawatts, 40 percent less than needed.

The 1,800-megawatt Daya Bay plant, due for completion by 1992, will not be able to make up the shortfall.

Another Guangdong electricity official said last month authorities wanted to complete two additional plants by the year 2000.

Though Daya Bay was chosen as the best site for the first nuclear plant, a number of other locations were considerable suitable as well.

Plans for additional plants in Guangdong have already drawn criticism from Hongkong's anti-nuclear lobby, whose campaign to block the plant was ignored by Beijing.

CHINA DAILY also said China was negotiating with French and West German firms for construction of two 600-megawatt reactors at Qinshan, Zhejiang, Province, only two kilometres from where China is constructing a 300-megawatt plant on its own.

The Reverend Fung Chiwood, chairman of the Joint Conference for the Shelving of the Daya Bay Nuclear Plant, said last night he believed that any decision to put a second plant at Daya Bay would be prompted by a desire to cut construction costs.

But the danger for nearby residents, including Hongkong, would be doubled, he said.

Storehouses Built for Radioactive Waste
51003002 Beijing XINHUA in English
1035 GMT 13 Mar 89

[Text] China is building storehouses for radioactive waste in all the mainland provinces except Hainan and Tibet.

An official from the State Environmental Protection Bureau said that 10 storehouses in Anhui, Sichuan, Tianjin, and other places will be built this year. Twelve storehouses in other provinces have already been completed.

The storehouses will help to tighten control on the discharge of radioactive waste produced by an estimated 1,000 industries and research establishments across the country.

The official said that some accidental pollution by radioactivity had occurred in recent years because of improper dumping.

The state has spent more than 42 million yuan on building the storehouses, which will have special equipment to monitor radioactivity.

They have been carefully sited to avoid pollution of the environment.

SOUTH KOREA

Research Reactor Construction Begins in Taedok
SK2603015289 Seoul THE KOREA HERALD
in English 26 Mar 89 p 3

[Text] Taejon—Ground was broken here yesterday for the construction of a Korean-developed multipurpose research reactor (MRR) that will be used in various nuclear power generation researches.

Science and Technology Minister Yi Sang-hui, Taejon Mayor Yi Pong-hak and Canadian Ambassador William Brian Schumacher and other government and nuclear officials attended the ceremony held at the Korea Advanced Energy Research Institute [KAERI] in the Taedok Science Town.

Minister Yi said in a speech that the establishment of the 70 billion-won reactor in 1992 will contribute to developing local nuclear industry and improving safety research activities.

"The accomplishment of this project would also save Korea about \$7.5 million in imports of nuclear materials because it would enable local production and test of fuels and other nuclear materials," said Yi.

According to nuclear officials, the 30 megawatt reactor has been designed and will be established with the utmost use of local technologies.

The reactor, an open-pool type using enriched uranium as its fuels, will be mainly used for testing and developing materials and fuels locally fabricated for nuclear power reactors.

Various types of radio-isotopes with high specific activities, including Tc-generator and Ir-192, will be produced by the reactor to meet local demand for medical and industrial applications.

The reactor will also be utilized for beam tube experiments and basic researches in neutron studies of diffraction and neutron radiography technologies for nondestructive test.

Officials said the reactor will be the fourth of its kind in the country. KAERI has two research reactors in Seoul, each with a capacity of 250 kilowatts and 2 megawatts, and Kyunghee University has an education reactor.

Currently, there are 326 research reactors in 56 countries around the world, according to the officials.

BULGARIA

Kozloduy Nuclear Unit Officially Opened

AU2303105789 Sofia Domestic Service in Bulgarian
1000 GMT 23 Mar 89

[Text] Our correspondent Veselin Angelov reports that the No. 5 generating unit, which has already begun operating, was officially opened at the nuclear electric power station in Kozloduy this morning. The 1,000-megawatt unit is the largest in our energy industry. Leaders of Mikhaylovgrad Oblast and the municipality, as well as many citizens, attended the festive meeting held to mark the occasion.

Over 30 specialized organizations took part in the construction of the unit, which incorporates highly efficient technologies, up-to-date mechanization, and equipment meeting the highest world standards.

In his greetings message to the investors, project designers, and construction and installation workers, Nikola Todoriev, chairman of the "Energetika" Association, noted the great part played by the Soviet scientific institutes and the cooperation with CEMA member countries. They have been awarded high distinctions, including the title "Hero of Socialist Labor (Five Stars)."

CZECHOSLOVAKIA

Plans, Delays in Nuclear Power Industry Noted

AU2903103689

[Editorial Report] Prague RUDE PRAVO in Czech and Bratislava PRAVDA in Slovak on 25 March both publish reports on a news conference given by Jozef Keher, CSSR Government commissioner for the construction of nuclear power stations, and "his collaborators," in Prague on 24 March.

Bratislava PRAVDA on page 2 carries a 250-word CTK report entitled "Development of the Nuclear Power Industry." It mentions that during their "fully reliable and safe operation" last year Czechoslovak nuclear power stations overfulfilled their planned output, which had been set at 22,890 gigawatt hours, by 398 gigawatt hours. Referring to the "long-term program for the development of the nuclear power industry," the CTK report notes that by the year 2000 the "installed capacity" of Czechoslovak nuclear plants should reach 10,280 megawatts, which means that four 440-megawatt units (all of them at Mochovce) and five 1,000-megawatt units (four of them at Temelin and one in East Slovakia) will be added to the eight 440-megawatt units already in operation.

Prague RUDE PRAVO in Czech on 25 March on page 2 carries a 400-word "pp"-signed report on the news conference headlined "Safely and Economically." The RUDE PRAVO report focuses on the current construction problems at Mochovce and Temelin. It notes that

because of delays in construction and in supplies of technology (which are blamed on the Kralovo pole engineering works and on Chemont Brno), the original deadline for commissioning the first unit of the Mochovce nuclear power station, October 1989, had to be postponed by 13 months, to November 1990. Although construction in Temelin is said to be proceeding more successfully, even here "a 3-month delay occurred because of the failure of the Kosice East Slovak Iron Works to supply steel structures."

GERMAN DEMOCRATIC REPUBLIC

Radiation Levels Continue To Decline

LD2303221189 East Berlin ADN International Service
in German 1704 GMT 23 Mar 89

[Text] Berlin (ADN)—In connection with the publication of information by the chairman of the USSR State Committee for Hydrometeorology on radioactive contamination in the USSR, 3 years after the reactor accident in Chernobyl, the GDR State Office for Nuclear Safety and Radiation Protection announces:

After the Chernobyl reactor accident, the monitoring of radioactivity on GDR territory was substantially expanded and steadily continued in line with requirements. So far, about 50,000 measurements have been made, of which 11,000 made in the initial stages were handed over to the International Atomic Energy Agency for inclusion in international evaluations.

The results of the studies show that since 1987 there has been an increasing reduction in radioactivity in all environmental media (atmospheric, precipitation, soil, water, foodstuffs, and fodder). The resulting radiation emissions for the GDR population amount to 1 percent of the natural radiation in 1988. In contrast to the situation in the USSR, there is therefore no problem on the GDR's territory.

The radiation situation will continue to be monitored.

POLAND

Hundreds Beaten in Antinuclear Demonstration

AU0204204489 Paris AFP in English
1949 GMT 2 Apr 89

[Excerpts] Warsaw, April 2 (AFP)—Riot police beat hundreds of demonstrators with truncheons and suffered 17 hurt among their own ranks Sunday when they forcibly dispersed thousands of anti-nuclear power demonstrators in Poznan, official and Solidarity sources in the western city said.

A Solidarity union spokesman in Poznan, Janusz Palubicki, said the riot police also used tear gas and water cannon in the protest against plans to build a nuclear power station at Kelpicz, some 60 kms (35 miles) north of Poznan.

One policeman was hospitalised and five vehicles belonging to the ZOMO [Motorized Reserve of the Citizens' Militia] riot [squad] were damaged, according to the news agency PAP, which said that no one was arrested and that some 200 people simply had their identities checked.

Meanwhile, in the northern Solidarity stronghold of Gdansk, some 2,000 people demonstrated Sunday, calling for independence for Poland and demanding the resignation of Polish leader Wojciech Jaruzelski.

Witnesses said police were conspicuously absent as demonstrators took to the streets following mass at the parish of Saint Brigit's, which was attended by Solidarity leader Lech Walesa. [passage omitted]

Mr Palubicki said that in the Poznan demonstration, the demonstrators from various organisations who had gathered for the occasion threw stones at the police in reply to their charges, but were forced to disperse after an hour of clashes.

It was then that many of them were beaten by the police who were out in force.

Opposition sources said similar anti-nuclear demonstrations also took place elsewhere in the Poznan region, at Gorzow-Wielkopolski, Pila and Wronki, but that police did not intervene in those demonstrations.

YUGOSLAVIA

Concern Expressed Over Krsko Plant Safety

LD2103093389 Belgrade TANJUG in English
0155 GMT 21 Mar 89

[Article by Ivan Ivkovic: "Chernobyl Could Happen in Yugoslavia"]

[Text] Belgrade, March 21 (TANJUG)—Yugoslavia's only nuclear power station, the eight-year-old Krsko, recently stopped production for the eightieth time, provoking local environmentalists to intensify their warnings about the possibility of a new Chernobyl in Yugoslavia.

Krsko was completed in 1981, but eight years later it has still not been granted an official operating permit from competent organs, making calls by Yugoslavia's green-oriented youth for its entombment in a concrete sarcophagus seem further and further from sheer folly.

Krsko has even succeeded in provoking a certain amount of panic from Yugoslavia's neighbours. In an article also quoted by the Yugoslav press, the Italian weekly EUROPEO called the plant an "incomprehensible object of darkness" about which not much is known except that it "produces" small radiation leaks, thermal pollution of Yugoslavia's longest river, the Sava, whose waters it uses for cooling purposes, has chronic spare parts problems and lacks space for storing spent radioactive fuel.

EUROPEO also quoted the West German weekly DER SPIEGEL, which has said that three nuclear bombs could have been manufactured from recycled atomic material from Krsko.

Austrian parliamentary deputy Holda Harich [name as received] has said that her government well understood Yugoslavia's problems and needs, but that it would not give up its demand for the plant to be shut down permanently. Austria has said it would cover one-half of the expenses of the plant's closure, which will cost at least two billion dollars. Italy and Austria are also considering making up for the energy deficit the Yugoslav republics of Croatia and Slovenia would suffer in the event of Krsko's closure.

Delegates in the Croatian Assembly said before the start of Krsko's construction that a nuclear power plant's operating life was about twenty years, that it could not pay for itself in that period and that conservation after twenty years would cost at least as much as the construction of a new one.

Nevertheless, the U.S. firm Westinghouse won the battle with common sense and the cornerstone of the plant was laid on December 1, 1974.

The contractual price of 700 million dollars very soon grew to over two billion dollars (due to interest on loans, breakdowns and failures to keep time limits), while the construction itself proceeded under a veil of secrecy—even the exact thickness of the steel dome of Krsko's reactor remains undisclosed to this day. This is not at all unusual in view of the fact that Westinghouse made savings precisely on the cupola of the Three Mile Island nuclear power plant's reactor in the United States, whose serious venting of radioactivity served as an overture to the Chernobyl catastrophe.

The Belgrade weekly NIN points to another similarity between Krsko and Three Mile Island—the vibrations which caused the so-called "China syndrome" (partial core meltdown) at the U.S. plant.

Officially, Krsko has not yet suffered any accidents, but its steam generators provoke anxiety of those in the know—Westinghouse has given up the production of this type of reactor and the United States Atomic Energy Commission (AEC) has stopped the construction of a nuclear power station in Puerto Rico which would have been Krsko's twin.

The seriousness of the situation is evidenced by NIN's unofficial report that Westinghouse has offered to completely replace the corroded steam generators in Krsko—with the proviso of being granted the construction of another nuclear power plant in Yugoslavia.

Under the present circumstances, such a deal is out of the question, as the country has decided not to build any nuclear power plants until the year 2000.

ARGENTINA

Profile of Nuclear Program; CNEA's Role, Status
51002048 Surrey NUCLEAR ENGINEERING
INTERNATIONAL in English Feb 89 pp 52-54

[First paragraph is NUCLEAR ENGINEERING INTERNATIONAL introduction]

[Text] There are two Argentine nuclear stations, totalling 1005MWe, in operation and another 745MWe unit is under construction. The operating units supplied 13.4 per cent of the country's electricity in 1987. Major efforts have been made to develop local capabilities in architect engineering and manufacture, and exports are being developed. Fuel cycle facilities include mining, enrichment and fuel fabrication and a pilot reprocessing plant is under construction.

Energy Resources

The length of the country from north to south is 2170 miles and its greatest width is about 868 miles. Well over a third of the population lives in the province of Buenos Aires.

There is almost complete self-sufficiency in energy. The main indigenous sources are natural gas, oil and hydro electricity. Reserves of coal are small and the main deposits, in the far south of the country, are low in calorific value. The principal hydroelectric schemes also involve lengthy transmission lines. Uranium reserves are significant (reasonably assured resources have been put at 12,000 t U_3O_8) with much of the country still to be prospected.

Natural gas and to a lesser extent oil are the major fossil fuels used for electricity generation; the part played by coal is minimal. The two operating nuclear power stations account for some 13 per cent of the output fed into the national grid system.

Electricity Supply

During the 1970s, when the first nuclear power station came on line, electricity demand was growing at over 11 per cent per year. By 1981 the growth rate was down to 3.3 per cent and in some parts of the country electricity demand actually fell, resulting in substantial spare capacity. Now demand is rising again. The 6.9 per cent increase in production to 48TWh in 1987 was well above the average of 4.9 per cent forecast for 1985-89. In the spring of 1988, there were power cuts in the Buenos Aires area, due to hydro shortages and nuclear outages. Demand is forecast to grow by 6.2 per cent per year between 1990 and 2000.

The total installed capacity of the national interconnected system was 12,089MWe in 1987. Some 84 per cent of the public capacity was owned by 5 utilities, including the national nuclear authority, the Comision Nacional de Energia Atomica (CNEA).

Industry accounts for 48 per cent of consumption, with domestic consumers taking 29 per cent and the commercial sector 11 per cent.

The sources of public electricity generation by fuel are shown in the diagram below. Two hydro schemes (El Chocón and Salto Grande) account for over half the hydro output. The diesel capacity is distributed between 1293 units, most of which are under 3kW. The maximum demand on the national interconnected grid system was 7,843MWe in 1987.

Nuclear Programme

The development of commercial nuclear power can be divided into 5 periods.

- During the first period (1950 to 1958), decisions were taken to set up the CNEA, people were trained in nuclear technology (mainly overseas), and the Argonaut 100kWt experimental reactor was built.
- During the second period (1958 to 1967), a 5MWt irradiation reactor was designed and built, uranium mining started, and the CNEA performed a feasibility study for a commercial nuclear power station.
- During the third period (1967 to 1976), turnkey contracts were placed for 2 natural uranium heavy water nuclear power stations (the Atucha 1, 357MWe PHWR with Siemens of FR Germany and the Embalse 648MWe Candu with Atomic Energy of Canada), uranium prospecting and production were stepped up, and a small domestically designed reprocessing plant produced the first plutonium in Latin America. (Footnote) (A good account of the early years of nuclear power in Argentina and of the negotiations for the first two nuclear stations is included in "Nuclear Power in the Developing World" by Daniel Pomerman, George Allen and Unwin, London, 1982).
- During the fourth period, which began in 1977, there was a considerable expansion of nuclear activity aimed at closing the fuel cycle and securing domestic capability to design and construct nuclear power plants. In 1979 the government approved a programme of 4 nuclear stations to be installed by 1997, but only one, Atucha 2 (745MWe PHWR), has so far been ordered (from Siemens-Kraftwerk Union).
- The fifth (and current) period, which started with the overthrow in 1982 of the military Junta after the Falklands war has been one of retrenchment. A new national energy plan approved in November 1987

calls for an additional 700MWe of nuclear capacity by 2000, but no decisive action has yet been taken. A site near Hernandarias in Entre Rios province has been suggested by CNEA.

Uncertainties

The construction of Atucha 2 has on several occasions been at a virtual standstill because of difficulties over financing, particularly overseas debt. There have also been labour problems. The station was 52 per cent complete at the end of 1988 and is now expected to enter service in 1994, some 6 years later than originally planned. A financial package on Atucha 2, which would involve the Argentine government matching new loans from the German government and Siemens, was signed in November 1988. Some 24 per cent of the CNEA's annual budget (\$700 million in 1987) currently goes on servicing foreign debts.

The future development of nuclear power is likely to remain unresolved until after the presidential elections in May 1989. The government of President Alfonsín has tended to favour the development of hydro rather than nuclear power. The opposition Peronist party is pushing for the reinstatement of the nuclear programme.

The CNEA believes that future energy demand can be met fully by a government-backed nuclear programme. A CNEA committee is expected to recommend to the government that a 700MWe PHWR design be adopted for all future domestic stations and for promotion abroad.

The committee has concluded that Argentina will need 14,000MWe of nuclear generating capacity before 2020 to meet projected demand. This, it maintains, could be achieved with a series of 700MWe units coming on stream from the year 1999 onwards.

There is also uncertainty over the future role and status of the CNEA which has suffered many earlier vicissitudes. In July 1987 the president of the CNEA resigned over the government's failure to guarantee adequate funding for the nuclear programme. His successor has set up an advisory council to make proposals for restructuring, including the possible formation of a new company to take over the running of the nuclear stations and the marketing of the CNEA's skills. The changes could include opening up the CNEA to private investment.

Organization

In the meantime the CNEA continues to be responsible for all aspects of the development of nuclear power (including the fuel cycle) and for the operation of nuclear stations. The CNEA comes officially under the Ministry of Public Works, but the president is closely involved. There are energy committees in both chambers of congress. In practice the CNEA has almost total autonomy under both civilian and military governments.

Decisions on the building of nuclear stations are taken by the government after consultations with the utilities. Projects are submitted to international bid and financed from government funds and foreign credits, usually from the supplier country.

Licensing, and the overseeing of nuclear power station operation and outages, is performed by the Advisory Committee for the Licensing of Nuclear Facilities (Calin), which is part of the CNEA. The CNEA also has a Directorate of Radiation Protection and Nuclear Safety, an Advisory Committee on the Application of Radioisotopes (CAAR), and a Safeguards Committee.

Local Industry

Major efforts have been made to increase the contribution from local industry to nuclear projects. The degree of local participation, which was 33 per cent at Atucha 1, is expected to reach 62 per cent in Atucha 2. During the construction of Embalse, the CNEA took responsibility for the erection of several of the critical components, such as the calandria, and the take-over date was extended to allow local companies to undertake the remaining erection tasks in both the nuclear and conventional islands. On Atucha 2, which is not a turnkey contract, the CNEA is responsible for domestic supplies and services. The two steam generators, three moderator coolers and the pressurizer for Atucha 2 have been manufactured in Argentina.

Enace (Empresa Nuclear Argentina de Centrales Electricas) was founded in 1980 by the CNEA (75 per cent) and Siemens (25 per cent) to take on the role of main contractor and architect engineer for the nuclear power plants of the Argentine nuclear programme, and it is currently in charge of the construction of Atucha 2. It is also active in transferring technology to other sectors of industry.

Through licensing agreements with AECL and Siemens, Enace has developed the Argos PHWR-380t (Argentine Offer of a Safer Pressurized Heavy Water Reactor).

In its current version it is equipped with a pressurized heavy water reactor of the pressure vessel type (like Atucha 1 and 2), but Enace says it could be adapted to use a pressure-tube reactor (Candu type). The reactor is designed so that it could accept an optimized low-enriched fuel cycle, and fuel spiked with self-generated plutonium or even with thorium. It had been expected that Argos would be adopted for any future Argentine nuclear stations, and it is being offered abroad. But the recent indication that the CNEA is favouring a 700MWe unit puts its future in doubt.

There have also been reports that Invap (Investigacion Aplicada), which is owned by the CNEA and the Rio Negro provincial government, has produced conceptual designs for a modular 7MWe LWR (Carem-15) that could be scaled-up to 150MWe for local generation.

and/or district heating. The government of the San Luis province is reported to have formed a commission, under former CNEA head Carlos Castro Madera, to study the feasibility of building a 25MWe version for base load.

Companies

Among the other Argentine companies involved in supplying equipment and services for nuclear power stations are:

Argatom - electro-mechanical erection at Embalse and Atucha, at the Arroyito heavy water plant and the Huarangal research reactor in Peru. Since 1985 the company has been particularly concerned with the commercial application of isotopes.

Gases Industriales - pressure vessels, heat exchangers and cryogenic tanks. The company was involved with Argatom and Tecnobridas in the supply and erection of components for the 10MWt research reactor in Peru.

Impsa - Steam generators and pressurizers for Atucha 2, and other Class 1 components.

Lockwood - water treatment plants, clean rooms and equipment for radiological protection. **Metalurgica Bellucci** - has supplied 3,000 nuclear quality valves for Atucha 2, under licence from Walton Weir (Spain).

Motomecanica Argentina - Butterfly valves for containment and cooling water systems.

Nuclear - installation and testing on all three nuclear stations, and maintenance on Atucha 1. In a joint venture with Kraftanlagen, the company has installed a high-pressure circuit for the thermo-hydraulic testing of fuel elements to be performed by the CNEA. It also has a cooperation agreement with Technicatome (France).

Picorrad - irradiation technology.

Techint - Part of SNIA Techint (Italy), it has been involved in nuclear projects in several countries.

Tool Research Argentina - HVAC system for Atucha 2 and ventilation and air treatment systems for other nuclear installations in Argentina and Peru.

Electromecanica Industrial Zoloda - Control panels.

Operation

Until 1983 the operating record of Atucha 1 was among the best in the world, with a cumulative load factor of 75 per cent. But since then the performance has varied widely and at the end of 1987 the cumulative load factor had fallen to 67 per cent. On some occasions operation has been restricted due to preferential use of hydroelectricity, but in the past 18 months there have been lengthy

outages due to a major inspection, a heavy water leak and suspected damage to fuel bearing coolant channels. The load factor for the 12 months to end September 1988 was 26.6 per cent. On 15 August 1988 the unit was taken out of service and, as of the end of 1988, was still depressurized and in cold shutdown. Replacement coolant channels are being fitted and new inspection and repair tooling has been manufactured. It was hoped to resume operation early in 1989.

For the 12 months to end September 1988, Embalse had a load factor of 86.9 per cent, and its lifetime load factor was 63.8 per cent.

Fuel Cycle

The aim from the outset has been to achieve self-sufficiency in the fuel cycle, including reprocessing, to provide plutonium for recycle or for use in FBRs.

Mining, milling and concentration to yellow cake (U_3O_8) are performed at the sites of three mines: Los Gigantes, in the province of Cordoba, operated by CNEA; La Estela, in the province of San Luis, operated by Sanchez Granel (a private company); and San Rafael, in the province of Mendoza, operated by Nuclear Mendoza (wholly owned by the provincial government). The output of U_3O_8 in 1987 was 95.4t.

Conversion to uranium dioxide is performed by the CNEA at Cordoba. The plant has two 150t/y lines, one bought from RBU, FR Germany, and the other based on local technology. Conversion to uranium hexafluoride and enrichment to 0.85 per cent is performed using gaseous diffusion in the Pilcaniyeu plant in the province of Rio Negro, which is owned by CNEA and operated by Invap. The plant has a capacity of 40,000SWU/y, which is being increased to 100,000SWU/y by 1990.

Fabrication of natural uranium fuel elements is performed by Conuar (Combustibles Nuclear Argentinos) at its factory at Ezeiza in the province of Buenos Aires. There are separate production lines producing fuel for Atucha 1 (240 elements per year) and Embalse (5360 elements per year). The factory can be extended to provide elements for all nuclear plants envisaged in the Argentine nuclear programme. PecoM Nuclear (part of Perez Companc Group) is the majority shareholder in Conuar, with the CNEA having the minority holding.

In 1986 Conuar and CNEA formed FAE (Fabricacion de Aleaciones Especiales) on the same site at Ezeiza to produce zircaloy tubes for the Atucha 1 and Embalse fuel elements, and related industrial products in stainless steel, titanium and special alloys. An ambitious export programme is envisaged.

A pilot reprocessing plant (5tHM/y) is due to start up in 1989, and in 1987 NEI reported that this was to be enlarged to industrial scale at a cost of \$100 million.

Irradiated fuel elements are stored at the two operating power stations. Atucha 1 has two pools with a capacity of 15 years and Embalse one pool with a capacity of 30 years.

A decision has yet to be taken on the disposal of highly radioactive waste. Investigations of possible waste sites began in 1977. A prefeasibility study is being performed near the town of Gastre, in the province of Chubut, for an underground repository in rock. It would take the waste from six nuclear stations.

The CNEA has two heavy water plants under construction. The experimental plant at the Atucha site has a capacity of 2t/y and was due to have started up in 1988. The industrial scale plant at Arroyito, province of Neuquen, will have a capacity of 250t/y and is due to start up in 1990. It is being built under a turnkey contract by Sulzer Brothers, Switzerland, and was 90 per cent complete in mid-1988.

Export Ambitions

In recent years there has been a determined effort to establish a presence in world markets as a supplier of nuclear equipment, particularly through the supply of research reactors. Argentine companies have been involved in the construction and supply of equipment for the Atomic Research Centre in Peru, which has been inaugurated recently. Training has also been offered to foreign engineers and technicians at the CNEA's Bariloche Nuclear Centre.

There have been talks with Iran on the possible completion of the 1300MWe PWR at Bushehr and Invap has signed a \$5.5 million agreement for the development of a new core for the research reactor at the University of Teheran, to enable it to work with 20 per cent enriched uranium. Shipment of the 116kg of fuel awaits IAEA approval.

Co-operation agreements have been signed with some 12 countries, including Brazil, Cuba, Turkey, Nigeria and Algeria. A co-operation agreement under negotiation with the United States covers mutual assistance in the case of accidents and is also expected to support Argentina's position as an exporter. U.S. assistance to Argentina was stopped in 1978 when Argentina refused to sign the Treaty of Tlatelolco. Trade talks with Canada have been suspended, following the Canadian's insistence on full-scope safe-guards, preferably under the NPT, though Canada is still committed to provide support for Embalse.

Co-operation with Brazil was formalized in May 1980 with the signing of an agreement on the development and application of the peaceful uses of nuclear energy. This agreement has served as a framework for ore specific agreements between the CNEA and the Brazilian National Nuclear Energy Commission and between the

CNEA and Nuclebras. This co-operation has been underlined by successive presidential protocols, the latest in Ipero in 1988 following visits to enrichment facilities in both countries.

One aim now is to substitute exports from third countries to save foreign exchange and reduce over capacity in the industries of the two countries. Each country is initially expected to produce about \$10 million of equipment for the other. The equipment will go to Angra 2 (Brazil) and Atucha 2. Possible export markets for joint effort are Peru and Mexico. The Argentine-Brazilian trade will be financed by a group of banks from the two countries co-ordinated by Latinequip, a foreign-trade company made up of Latin American banks.

Brazil and Argentina are working together on a small (100MWe or less) FBR to be developed over the next 25 years. In November 1987 a co-ordinating committee of Argentine and Brazilian businessmen in the nuclear area was formed (CEBAN). In Argentina the committee works through the private industry group Asociacion Argentina de Tecnologia Nuclear (AATN).

Safeguards

Argentina has refused to sign the Non-proliferation Treaty because it regards it as discriminatory—a treaty for the disarmament of the disarmed. It has said it would sign the treaty if it were modified to provide equal rights and obligations for all parties and was signed by the weapons states. There have also been desultory discussions with the IAEA over many years on the conditions that would lead Argentina to ratify the Treaty of Tlatelolco. The sticking point has been Argentine insistence on keeping the option to make "peaceful" nuclear explosive.

BRAZIL

Army Tests Nuclear Emergency Evacuation Plan
PY2903015389 Brasilia Domestic Service in Portuguese
2200 GMT 28 Mar 89

[Text] Today the Army tested the first part of the emergency evacuation plan in Angra dos Reis, in Rio de Janeiro. The test has three stages and will last 3 days.

The Army conducted the first part of the emergency evacuation plan for a nuclear accident in Angra dos Reis nuclear plants. The text, which includes the evacuation of the area's population, will end on 30 March. The program has three stages: the first deals with concentrating the area's population in 16 strategic points; the second details the evacuation of the population from Angra and their transport to nuclear shelters; the third envisions the population's return and the end of the emergency.

Major Benji of the 1st Army Division heads the operation in which 900 men play the role of area inhabitants. The population does not participate in this test. In case of a true emergency evacuation the local prefecture would be responsible.

Angra's secretary of special events, (Evan Silva), said, however, that the prefecture is unable to pay the expenses for the population's evacuation:

[Begin recording] The prefecture can only alert the population to go to the points of concentration. The Army would then be called in to take over. We want to make clear that the prefecture will not assume the responsibility for the evacuation. We do not have the funds or the infrastructure needed for the job. [end recording]

The Army wants to assess the time spent in gathering the population and their transport by bus and train to the shelters. The most important part of the test, however, will come in the second half of the year when the population participates in the exercise.

Negotiations for Enriched Uranium Purchase Noted

PY1603102589 Sao Paulo FOLHA DE SAO PAULO
in Portuguese 10 Mar 89 p 7

[Report from Rio de Janeiro by correspondent Tania Malheiros]

[Text] The Brazilian Government is negotiating with URENCO (an FRG-British-Netherlands consortium) for the purchase of enriched uranium for recharging nuclear fuel for the third time in the Angra-1 nuclear plant, located in the municipality of Angra dos Reis in Rio de Janeiro State, FOLHA has found out. John Albuquerque Forman, president of Nuclear Industries of Brazil (INB)—the enterprise that replaced NUCLEBRAS—confirmed that information yesterday. According to Forman, URENCO representatives sent a telex to the INB this week, announcing that they will come to Brazil in April to discuss the terms of the deal.

Forman affirmed that a charge for Angra-1 requires an average of 66 tons of Separation Work Units (UTS); that is, uranium enriched to 1.2 percent, 2.8 percent, and 3.2 percent. He said the current market price of a UTS is \$90 to \$120. The INB president said: "We are in fact going to review the contract for enrichment because the current one dates back to 1978 or 1979." He also explained that the INB does not buy uranium enriched by the Navy at the Aramar Experimental Center in Iperó, 123 kilometers from Sao Paulo, because "the process there is not yet on an industrial scale."

In order to not interfere with the negotiations, Forman did not want to estimate how much the INB will pay to URENCO this time for enriched uranium. He said: "It all depends on the type of contract we sign. We have to

take into consideration whether the contract will be a medium- or long-term contract. It must be evaluated carefully. It is one thing to use 10,000 UTS per year, but 10,000 UTS in 10 years is something else." According to Forman, the negotiations with URENCO will be conducted by the INB commercial manager. FOLHA has found out that the uses for nearly 30 tons of depleted uranium (residues) that Brazil has in Great Britain will be discussed at the meeting.

The depleted uranium is the remainder of the uranium that was used for manufacturing the first two charges for Angra-1. This nuclear plant is working at 52-percent capacity of its reactor, generating 350 megawatts, which represents 10 percent of the electricity consumed by the Rio de Janeiro population. Furnas does not increase the unit's operation to 100-percent generating capacity because, according to its president, Camilo Pena, "it is not necessary." In this way, Furnas is also saving nuclear fuel. Next August, the Angra-1 plant will be charged for the second time with nuclear fuel stored in Resende, Rio de Janeiro State.

CHILE

Nuclear Cooperation Pact Signed With PRC

PY1703232889 Santiago Television Nacional de Chile
in Spanish 1800 GMT 17 Mar 89

[Text] Chile and the PRC today signed a cooperation agreement on the peaceful use of nuclear energy.

The agreement was signed by China National Nuclear Corporation President Jian Xinxiong and by National Commission for Nuclear Energy Chairman Lieutenant General Hernan Brady.

The cooperation agreement provides for the promotion of scientific and technological research work through visits and the training of professionals in Chile and the PRC. The training will include subjects related to the geology, the mining, and the leaching of uranium.

CUBA

Soviets To Help Build Nuclear Research Center

FL1403040989 Havana Radio Rebelde Network in
Spanish 0032 GMT 14 Mar 89

[Report by Gisela Bel Heredia during "Exclusivo" program]

[Text] The Raul Roa Garcia and Jose Antonio Echeverria Contingents were inaugurated this afternoon in Havana. They will participate in the ground breaking and building of the Center for Nuclear Research, CIN.

A list of the workers' commitments was read by Comrades Carlos de la Fuente and Lazaro Mendizabal and the banners were received from the first secretary of the party in Havana, Jorge Lezcano Perez. Afterwards, (Kirvon Der), chief of the Soviet advisors, spoke to the construction workers.

[Begin (Der) recording, in Russian with simultaneous Spanish translation] We, the Soviet and Cuban construction workers, should direct our efforts toward the unconditional completion of the first stage of the center. The complex will become operational in 1991.

The Soviet specialists working on the construction of the center will do everything required of them so that the work advances according to schedule. We are certain that the Soviet organizations in Moscow, which have made a commitment to guarantee the construction of the CIN, will also fulfill their obligations and guarantee the equipment and material necessary, as well as the technical documentation required. Even though we currently have some difficulties in certain areas, we are certain that with the joint Soviet-Cuban effort we will overcome these difficulties and we will fulfill the task on schedule. [end recording]

The closing remarks were made by Pedro Ross, secretary of the Central Committee of the Communist Party of Cuba, who stressed the importance of building this investment with contingents. He also referred to the salary system, discipline, and work of these forces.

The immediate task of the ground-breaking contingent will be a work program that includes the completion this year of the ground breaking for the Isotope Center, the CIN, and other small projects. The collective has 69 pieces of equipment and 100 outstanding workers, including members of the party and the UJC [Union of Young Communists].

This is all for the moment, good evening.

PERU

New IPEN Head Sworn In by Energy Minister
PY2903144189 Lima Television Peruana in Spanish
0100 GMT 29 Mar 89

[Excerpts] Mines and Energy Minister Jose Carlos Carrasco Tavaras today swore in the new President of the Peruvian Institute of Nuclear Energy [IPEN], retired Rear Admiral Cristobal Miletich Souza.

At the end of the ceremony, Miletich Souza stated that the Huarangal Nuclear Plant will begin operating within 6 months. [passage omitted]

[Begin recording] [Reporter] What are your main objectives as you begin your administration?

[Souza] We have several projects in mind. Some are much more urgent than others. We intend to begin the microwave project for food irradiation.

We also intend to exploit the Macusani uranium mines, which will surely become a source of foreign currency for the country. We also intend to foster many other projects for the use of nuclear energy in the medical field and in the metalworking industry.

Most of all, we want to make IPEN personnel feel proud to belong to the most advanced technology center in the country. If all those people work with pride, our projects will be successful, because of their initiative and creativity.

[Reporter] Do you think we are making progress with nuclear energy?

[Souza] Of course. The dedication of the Huarangal Nuclear Plant has been the first step. My task will be to put it into operation within 6 months. We hope to do so as soon as possible, because this will also be a source of currency. As soon as we can produce radioisotopes, we will sell them to neighbor countries. I think we already have an agreement to supply Argentina with radioisotopes. The plant can be a source of currency, as well as a research center the country needs now.

Our scientists will be able to train there without having to go abroad. Training here will make them proud and happy to belong to this institute. The institute will do all it can for the good of the country. [end recording]

ALGERIA

Bendjedid Inaugurates First Nuclear Reactor *LD0304221189 Algiers Domestic Service in Arabic* *1200 GMT 3 Apr 89*

[Text] President Bendjedid today visited Draria, near El Achour, to inaugurate the (Nour) nuclear reactor, accompanied by a number of National Liberation Front (FLN) and state officials. Correspondent Hasiba reports:

When the president arrived at the first Algerian nuclear reactor he toured its various departments, where he was given detailed explanations about the duties of each department.

The (Nour) nuclear reactor was designed and its equipment made in Argentina, with effective participation of Algerian workers in all stages of its manufacture. Ninety-nine percent of (Nour's) equipment and facilities were manufactured in Argentina. The assembly and testing were carried out with the participation of Algerian workers. The civil engineering part was carried out by an Algerian organization under Argentine supervision.

The nuclear reactor and its fuel are subject to IAEA [International Atomic Energy Authority] security according to an agreement between the Algerian and Argentine governments.

To carry out its work in the best possible way, the nuclear reactor contains the following equipment: a thermal nuclear reactor for education and research; a test laboratory using a nuclear radioactivator; a laboratory for reactor physics; a laboratory for equipment and monitoring; a transformation cell; a hot cell for producing radioactive isotopes; a workshop for electric and electronic maintenance; a mechanics workshop; a library; and lecture halls.

The nuclear reactor will be used for the following: participation in teaching reactor engineering; organizing and securing the applied work of reactor engineering around the reactor and its auxiliary facilities; securing the exploitation of the reactor and providing the neutron bundles and radioactive channels for users; securing the production of radioactive isotopes; carrying out, together with other research cadres, research work in the field of development of nuclear reactor physics and the special equipment for the reactor and its monitoring, and also research in the field of application of neutron bundles, such as analysis by neutronic radioactivation and neutrographics, and studying the effects of radiation on materials.

Uranium Plant Agreement With Argentina Denied *LD0304224389 Algiers Domestic Service in French* *2200 GMT 3 Apr 89*

[Text] The commissioner for research Mr Hadj Slimane has issued a clarification about the reactor which was inaugurated this morning. During a news conference at

Aurassi Hotel this afternoon, Mr Hadj Slimane denied the information published in foreign newspapers alleging that Algeria and Argentina have signed an agreement for the installation of a uranium-enrichment plant in Algeria. He stated that an outline agreement does not exist either in this field or in any other.

BAHRAIN

'Chernobyl' Contaminated Beef Held Under Tight Security

44000371 Manama GULF DAILY NEWS in English
28 Feb 89 p 5

[Article by David King]

[Text] Two tonnes of topside beef, believed to have been contaminated by radiation from the Chernobyl nuclear accident, is being held at a secret location in Bahrain amid tight security.

The frozen meat was dumped on the island last week having been twice rejected by Saudi Arabian customs officials.

A ship carrying a container of the highly contaminated radio active docked at Mina' Salman port last Monday. It is understood from sources at the port that the meat originated from West Germany.

'Ali al-'Askari, head of the food hygiene section at the Ministry of Health, refused to reveal the origin of the meat.

But he admitted that the likely cause of the radioactive produce was from the 1986 accident at the Chernobyl nuclear plant in the Soviet Union.

Mr al-Askari said: "We believe the cause of the contaminated meat is related to the Chernobyl disaster.

Mr al-Askari revealed that the potentially lethal meat first came to the attention of Saudi authorities when the ship berthed in Jeddah.

"The meat was inspected by the authorities as part of a routine check and it was discovered it had a high level of radioactivity," said Mr al-Askari.

All GCC states have a standard that meat should contain no more than 75 bequerelles—a measure of radioactivity.

The limit for milk products is 30 bequerelles, water 10 and animal feed, 300.

Mr al-Askari had no figures for the contaminated beef, but it is understood to be considerably in excess of the 75 benchmark.

The food was sent back from Saudi to the country of origin but later returned to Dammam together with a certificate showing that the level of radiation in the meat registered 65 bequerelles.

But the Saudi authorities were not convinced and rejected the meat. The ship arrived at Mina' Salman last week.

BANGLADESH

'Early' Implementation of Rooppur Ordered

51500083 Dhaka THE BANGLADESH OBSERVER
in English 8 Feb 89 p 10

[Text] President Hussain Muhammad Ershad on Tuesday directed the concerned authorities for early implementation of the Rooppur Nuclear Power project, reports BSS.

The President gave the directive while presiding over a high level meeting which discussed in thread bare the salient features of the project. The meeting also reviewed and examined the economic and technical aspects of the project.

President Ershad asked for formation of a joint venture company for expeditious implementation of the project.

He expressed his satisfaction for considering the safety aspects as the main criteria for selection of the technology for the project.

It was also decided in the meeting that a committee to be headed by Minister for Energy and Mineral Resources should make efforts to line up finance for the project.

The meeting held at the President's Secretariat was attended by Minister for Energy and Mineral Resources A.B.M. Ghulam Mustafa, Minister for Planning A.K. Khandaker, Principal Secretary to the President A.H. Sadik, Secretaries of the Energy and Mineral Resources Ministry and External Resources Division and Chairman of the Atomic Energy Commission.

Mannan New Head of Atomic Energy Commission

51500082 Dhaka THE BANGLADESH OBSERVER
in English 9 Feb 89 p 3

[Text] Dr M.A. Mannan, member (Physical Science), Bangladesh Atomic Energy Commission took over as the chairman, BAEC on Tuesday. He has been holding the charge of the office of the chairman BAEC since 6 November 1988 when Dr Anwar Hossain retired, says a Press release.

He is the 3rd chairman of BAEC. Dr Mannan joined the erstwhile Pakistan Atomic Energy Commission in 1959 and held various positions in Pakistan and Bangladesh. He was appointed Member, Physical Science of the

Commission in October, 1983. He was the first Director General of Atomic Energy Research Establishment (AERE), Savar. He worked as a consultant to Atomic Energy Organisation of Iran during 1976-79 on deputation.

Dr Mannan had a brilliant academic career. He had his early education in Kutubpur High Madrasa and Rajendra College, Faridpur. He got his M.Sc. Degree in Physics from Dhaka University in 1957, and M.S. and D.Sc. Degree from the University of Michigan, U.S.A. in 1960 and 1964 respectively. He is a reputed Reactor Physicist. He was responsible for planning, implementation and safety evaluation of the first research reactor of Bangladesh. He is actively associated with many national and international professional organisations.

Concern Over Dumping of U.S. 'Nuclear Waste'

BK2403123089 Dhaka SANGBAD in Bengali
17 Mar 89 pp 1, 7

[Text] Mrs Khaleda Zia, chairman of the Bangladesh Nationalist Party (BNP) and leader of the Seven-Party Alliance, has expressed grave concern over the report that U.S. ships have secretly dumped very dangerous nuclear waste inside the territorial limits of Bangladesh and called upon everyone, including humanitarian and environmental scientists, social workers, intellectuals, and politicians, to raise their voices against it.

In a statement, she said that an American weekly has published a report quoting two American professors of environmental concerns. She said the government has remained mysteriously silent on it, despite reports published on various occasions in Bangladesh newspapers about the entry of such American ships into the territorial waters of Bangladesh and warnings given by some circles from time to time.

Mrs Khaleda Zia has demanded an unambiguous explanation from the government on this issue.

INDIA

New Surface-to-Surface Missile Test in Apr

BK2903135689 Hong Kong AFP in English 1328 GMT
29 Mar 89

[Text] New Delhi, March 29 (AFP)—Indian experts have begun a countdown on a new surface-to-surface (SS) missile to be tested next month, the PRESS TRUST OF INDIA (PTI) said Wednesday. The SS missile, codenamed Agni (fire), would be launched from a test range in the Chandipur area southwest of Calcutta in the eastern state of Orissa, the news agency said.

PTI did not give the exact date of the launch in April but said local residents from several villages in the area would be moved 2.5 kilometres (1.5 miles) away as a precaution. They would be given a week's notice to move, V.S. Arunachalam, scientific advisor to the

Defence Ministry, was quoted as saying. He told reporters at Chandipur that the evacuation was necessary as the missile's technology was not foolproof.

Previous plans to launch the SS missile have been aborted due to fierce resistance from some 10,000 villagers in the area who have expressed fears that the test might lead to large-scale destruction of crops.

Agni is India's first attempt at launching a military rocket with the capability of an Intermediate Range Ballistic Missile (IRBM). It has a range of 2,500 kilometres (1,550 miles), defence officials here said.

Mr. Arunachalam said New Delhi would not be able to afford more than three tests of the IRBM-class missiles in a year and described next month's test as a "technological demonstration."

More than 300 experts and defence scientists were said to be preparing for the launch from reinforced sunken bunkers.

Several vital components of the SS missile, capable of carrying atomic warheads, have been brought to Chandipur from a defence laboratory in southern Hyderabad city and would be fitted at the test site, Mr. Arunachalam said.

The missile, developed by the state-owned Defence Research and Development Laboratory (DRDL), features a first-stage solid propellant engine and a second-stage liquid-fuel motor.

In July, India unsuccessfully tested a locally-built Augmented Satellite Launch Vehicle (ASLV) which crashed into the Bay of Bengal 150 seconds after take-off.

The conventional first-stage engine with a range of 1,500 kilometres (932 miles) used in the Agni missile is similar to the one used in the Satellite Launch Vehicle-3 class rockets.

The Agni's launch comes 13 months after the successful test-firing of a short-range SS missile, which made India the fifth country after the United States, the Soviet Union, France and China to have developed such a weapon.

The SS missile, codenamed Prithvi (earth), had a flight-range of 250 kilometres (155 miles) and formed one of the mainstays of India's ambitious integrated guided missile development programme which has developed a family of missile systems since 1983.

Natwar Singh Rejects Area Nonproliferation Plan *BK2903094589 Hong Kong AFP in English* *0919 GMT 24 Mar 89*

[Text] New Delhi, March 29 (AFP)—Pakistan suggestions for a regional or bilateral approach to preventing the proliferation of nuclear weapons are unacceptable, an Indian minister said Wednesday [29 March].

"They have never been acceptable to us as we feel that this issue can only be tackled on a global basis given the global reach of nuclear weapons," Indian Minister of State for External Affairs Kanwar Natwar Singh said in a written reply to a member's query in parliament's upper house.

The statement appeared to have been provoked by Pakistan Prime Minister Benazir Bhutto's advocacy of a regional approach to nuclear non-proliferation in an interview published by the INDIAN EXPRESS newspaper here on March 21.

She was quoted as saying that a regional solution was "an inherent ingredient" to prevent the proliferation of nuclear weapons in Asia.

"The reason why we view this matter regionally is because if one country in the sub-continent makes a bomb it will put immeasurable pressure on the other countries to resort to the same strategy," she said. Ms Bhutto added that "while global non-proliferation is a worthwhile objective to pursue, nonetheless the regional option should not be excluded."

Neither India, which in 1974 exploded what it called a peaceful nuclear device, nor Pakistan is a signatory to the Nuclear Non-Proliferation Treaty (NPT).

New Delhi believes the treaty discriminates in favour of nuclear states. Islamabad has said it would be willing to sign the NPT if India did.

India has frequently charged Pakistan with pursuing a clandestine nuclear weapons programme, a charge that Islamabad has consistently denied.

Mr Natwar Singh said India believed it would be in the interest of both countries to improve relations, which have been thawing since Ms Bhutto assumed office in Pakistan last year. Improved relations would lead to a reduction in defence spending and free resources for development, the minister said.

Indo-Pakistan relations have been embittered by three wars since the sub-continent gained independence from British colonial rule in 1947, and other disputes including ownership of the frontier territory of Kashmir.

Construction of 6 Nuclear Power Plants Approved
BK0104161089 Delhi Domestic Service in English
1530 GMT 1 Apr 89

[Text] The Center has cleared six nuclear power plants with 500-megawatt capacity each. Talking to newsmen at Tirucharappalli today, the managing director of the Nuclear Power Corp., Mr S.L. Katti, said two plants will be located at Tarapur and the remaining four at Kota in Rajasthan. He said India has become the seventh nation in the world to have developed indigenous technology for setting up nuclear power plants with the commissioning of the Narora plant last month.

High Possible Leak Rate Delays Plant Commissioning

51500080 Bombay THE TIMES OF INDIA in English
18 Jan 89 p 1

[Article by S. Kumar: "Safety Rules Hold U/p Narora Plant"]

[Text] Bombay, Jan 17—The commissioning of the Narora Atomic Power Plant (NAPP) has been delayed by over four months because of safety considerations. The plant has not met the safety specification stipulated by the [AERB] Atomic Energy Regulatory Board.

NAPP was originally slated for commissioning in October, 1988. Subsequently, it was postponed to December and then January. As a result of the tough stand taken by the AERB, the plant will probably be commissioned only early next month.

At least three major conditions are to be met before the AERB gives it clearance. The first is that the "leak rate" from the reactor containment should be brought down.

The reactor unit has a double containment wall. While the inside wall can withstand a maximum pressure of 1.25 kg per sq. cm. the outside wall can withstand 0.07 kg per sq. cm. The containment is supposed to be leak-proof so that in the event of any mishap, radioactive elements will not escape from the containment.

If an accident occurred and a certain amount of radioactivity was released only 0.1 per cent of the total volume of radioactivity can be allowed to escape. Current measurements, however, show that the leak rate could be up to 0.3 per cent, or three times more than the expected level.

Initially, the plant authorities pleaded with the AERB that they would detect the source of trouble and rectify it before the plant began power generation. They also sought permission to make the reactor "critical," that is to test its operation at a very low level. AERB did not allow this.

The authorities are scanning the containment wall to detect the minute pores that could have led to the higher leak rate. Once these pores are plugged, the leak rate will come down to the safe level.

Even when the reactor is operated at its full power level, there is no danger of any leak and stringent precautions are taken only to deal with accidents, according to the sources.

No Habitation

Another condition to be fulfilled by NAPP is that the 1.6 km exclusion zone around the plant should be totally cleared of any habitation. The land in the zone is yet to be acquired. The Uttar Pradesh government has to issue the necessary notification to expedite the land acquisition.

The AERB further said that the plant should instal systems for detecting microseismic activities.

To meet the target date of commissioning, these shortcomings could have been ignored since they do not pose any immediate danger.

But, the setting up of AERB has changed the situation. The Nuclear Power Corporation has come to accept the role played by the AERB which has begun to assert itself as an independent agency, enforcing safety regulations.

Economy, Safety of Nuclear Power Explained

Safeguards Outlined

51500097 Madras THE HINDU in English 4, 6 Feb 89

[4 Feb 89 p 8]

[Text] "Nuclear power is an advanced and exacting technology, but there is nothing mysterious about it. Its level of safety is high and can be made even higher, and it is environmentally benign. It would be paradoxical if the world were to reject this clean source of electricity while being unable to do away with some 50,000 nuclear warheads," said Dr Hans Blix, Director-General, of the International Atomic Energy Agency (IAEA), in a speech on the "Dynamics of Chernobyl: Analysis of the Consequences and Proposals" in Rome on February 26, 1987.

In the face of all the hyperbole, emotive diatribe, rhetoric, assertions and counter-assertions which mark the debate over increasing India's nuclear power capacity nearly ten-fold by the turn of the century, a global perspective is perhaps needed.

Chernobyl has not sounded the death knell of the world's nuclear industry any more than the Challenger disaster ended space shuttle flights. In both cases, after the initial shock, the causes were studied and remedial measures taken, but neither was abandoned. The Union Minister

of State for Science and Technology, Mr K. R. Narayanan, expressed this philosophy very pithily: "When technology creates problems, it is in science itself that solutions might be sought; the alternative is to go backwards."

Renewed Commitment

The Chernobyl accident led to a great deal of introspection as all over the world; the nuclear industry thoroughly reviewed design aspects and operational procedures of nuclear plants. But it did not lead to wholesale abandonment of nuclear power as a source of energy. Countries such as the U.S., the UK, the Federal Republic of Germany and the Soviet Union have issued policy statements reaffirming their commitment to the development of nuclear power. There are 123 reactors under construction in 20 countries which in the early 1990s will add 110,474 MWe to the world's existing nuclear power capacity of 318,612 MWe from 427 reactors. Then nuclear power would be responsible for 20 per cent of the world's electricity generation as against the current 16 per cent.

Decisions to persist with nuclear power are based on hard-nosed realism. Worldwide, nuclear power is economical. It allows the husbanding of nonrenewable fossil fuels which have other uses apart from energy production. The deposits of these fossil fuels are after all strictly limited, and the more economically they are used, the longer they will last.

A study by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) found that natural background radiation accounted for three-quarters of the radiation received by an average person, medical requirements for another 25 per cent, and nuclear power production for only 0.01 per cent.

In several countries, nuclear power programmes have reduced emissions from the use of alternative fuels. In France, for example, where 70 per cent of the electricity is nuclear-generated, it is reported that nuclear power had halved sulphur and nitrogen oxide emission from fossil fuels since 1980. The fact is that every energy source has costs and risks associated with it and there is little reason to conclude that these are higher for nuclear energy.

When the Soviet Union, which has abundant oil and other natural resources, decided, even after the Chernobyl experience, to increase its nuclear power capacity five-fold to about 150,000 MWe by 2000 A.D., it may not be wise to presume that they are crassly indifferent to the wellbeing of the populace or just plain stupid. Even the earthquake-prone Japan, where a major quake is expected to rock Tokyo any time, has plans to increase its installed capacity from the present 27,000 MWe to some 43,000 MWe by 2000 A.D.

Modest Plan

The Indian nuclear establishment's plans are more modest: to raise the installed capacity from the current 1,230 MWe to 10,000 MWe by 2000 A.D. Nuclear power's contribution to the total electricity generated in the country could then rise from the present two per cent to 10 per cent.

A developing economy needs electricity for its growth. Electricity is required in ever-increasing quantities for agriculture as well as for industry, the latter accounting for about half of the electricity consumed in India and the former for a fifth. The demand for electricity is growing at nearly 10 per cent every year. Every State complains of insufficient electricity for its needs and power cuts are a part of daily life. India, with its yawning "power gap," is not in the position of the developed countries which have enough power generation capacity at hand and which therefore have the option of not adding to the installed capacity, whether conventional or nuclear power.

Alternative Sources Too

"Nuclear power will supplement, not replace, the power from hydroelectric stations and thermal power stations," points out an official of the public sector Nuclear Power Corporation (NPC). "Nor does the development of nuclear power preclude the use of renewable and alternative sources of energy. It is not an either-or situation, but a question of using all available sources efficiently to meet the country's energy needs in the immediate future as well as in the long term."

Nuclear power is competitive in the Indian context as well. The cost of electricity generated at the Tarapur Atomic Power Station is 43.47 paise per unit (kilowatt hour) 48.46 paise per unit for the Rajasthan station, and 50.39 paise per unit for the Madras station at Kalpakkam, observed the NPC's Managing Director, Mr S. L. Kati. This compares favourably with the cost of generating electricity from thermal plants of about the same capacity: 63.66 paise per unit for power from Wanakaboni, 76.05 paise per unit for the Kota Thermal Plant's power, and 61.55 paise per unit for Tuticorin power.

Considerable Advantage

Nuclear power enjoys a considerable advantage over thermal power if the latter plants have to be situated far away from the coalfields. The reason is simple: a 1000 MWe thermal plant would require the transportation of three million tonnes of coal a year while a nuclear plant of equivalent capacity would need a mere 50 tonnes of fuel a year. The Indian coal deposits are restricted to a few places, a great deal of it in the eastern part of the country.

Flak From Critics

But the nuclear power programme to have an installed capacity of 10,000 MWe by 2000 A.D. has been attracting considerable flak from the vocal anti-nuclear lobby. "Nuclear power is an idea whose bright future is already behind it. The dream of a source of electricity which would be clean, safe and too cheap to meter has turned into a nightmare," says ANUMUKTI, which professes to be a "journal devoted to non-nuclear India." Safety is the greatest concern of the anti-nuclear movement which believes that all types of nuclear reactors now in operation around the world are unsafe. India's CANDU (Canadian Deuterium Uranium) reactor is not immune to a large, uncontrollable fuel melting accident, goes its refrain. Such an accident, with radioactive substances spewing out, would have disastrous consequences for people not just in the immediate vicinity but on an extraordinarily large area around. Even if the chances of such an accident happening were low, the consequences were too great for the risk to be worth taking.

Deep Study

The nuclear establishment believes otherwise. A Department of Atomic Energy (DAE) brochure on "Nuclear and Environmental Safety," points out that "it will not be an exaggeration to say there is no parallel to the detailed and deep study undertaken in the nuclear industry in general and for nuclear power plants in particular." It is the only industry in which it is insisted that all possible accidents be analysed and in which one is required to ensure that even in the event of the severest accident, the exposure of the public to radiation does not cross internationally accepted levels.

The CANDU reactors use natural uranium fuel which contains 99.28 per cent of Uranium-238 and 0.715 per cent of uranium-235. When uranium-235 is exposed to neutrons, some of its atoms absorb neutrons. Each of these atoms by a process of fission split into two nearly equal fragments, releasing a large amount of energy and two or three neutrons as well. But these neutrons move too fast to split other uranium-235 atoms and have to be slowed down with a moderator. Once one of the neutrons produced in each fission can produce one further fission, a chain reaction is established with a steady release of energy and the nuclear reactor becomes "critical."

Heavy Water Moderator

In the CANDU reactor, a huge horizontal cylindrical vessel (calandria) houses the fuel bundles as well as the heavy water which is used as moderator. The calandria is penetrated by a large number of zircalloy pressure tubes (306 in a 235 MWe reactor). The fuel bundles are housed in these tubes and heavy water under pressure is passed through to act as a coolant. (The heated heavy water

passes to the steam generators where the heat is transferred to ordinary light water raising steam which then drives the turbines which produce electricity, while the cooled heavy water is returned to the coolant channels.

Safety Features

These pressurised heavy water reactors (PHWR) have several inherent safety features, say the nuclear scientists. These include:

- The neutron generation time for such a reactor is about 0.001 second an order of magnitude greater than that for enriched uranium light water reactors. Since reactivity transients for a given reactivity variation are much slower in a PHWR, they are much easier to control;
- As PHWRs are refuelled on-power, the excess reactivity reserve in the core is kept to a minimum. Thus the reactivity control elements do not have to be quite so powerful and malfunctions, if any, result in manageable transients;
- The control and shutdown devices operate in a low-pressure, low-temperature moderator environment. So there is no possibility of their being ejected out of the core;
- The reactivity of the reactor core does not significantly increase even in the event of a redistribution of the core in accident conditions;
- There is no large pressure vessel in the coolant loop of the PHWR. The largest rupture that can occur in the primary system is limited to the size of the reactor headers;
- The cold heavy water moderator occupies a large part of the core, and can serve as an important heat sink;
- Natural uranium dioxide fuel with a low content of fissile materials precludes reactivity accidents in fuel handling and storage;
- Burnable materials such as graphite are not used in the core.

First Commandment

Even so, defence-in-depth—a strategy for expecting the unexpected—remains the nuclear engineers' first commandment. An IAEA pamphlet put out a few months ago commented: "Plants are designed and operated on the concept of defence-in-depth, which actually anticipates and compensates for human errors, equipment malfunctions and extreme natural phenomena. The strategy is twofold: to prevent accidents and, if this fails, to mitigate their consequences...."

An outstanding indication that defence-in-depth has been properly implemented is a record of smooth, steady performance in producing electricity on demand, with little or no need to draw on safety systems."

Double Containment

Physical barriers are provided which would all have to be breached for radioactive material to escape from the nuclear plant. These barriers are the fuel matrix itself, the zircalloy fuel-cladding, the closed-loop primary heat transport system (including the coolant tubes in which the zircalloy-clad fuel resides), and finally the double-containment building which houses the entire reactor system.

The Narora atomic power station (NAPS), the first unit of which is to be commissioned shortly, is the first to be provided with full double-containment. The RAPS has only single-containment while the MAPS has partial double-containment. The inner containment of prestressed concrete will withstand an internal pressure of 1.25 kg/sq.cm., the highest pressure anticipated in an accident. The outer containment of reinforced concrete can take a pressure of 0.07 kg/sq.cm. The two envelopes, which have a leak rate of less than 0.1 per cent of the contained volume per hour at their respective design pressures, will hold in any radioactive releases that do take place.

Special Safety Systems

But these passive barriers are a mere icing on the cake. Ordinarily, the plant's complex control systems would keep it functioning safely. In the event of abnormal occurrences, there are separate protection and safety systems which can shut down the reactor, keep it safely sub-critical, maintain cooling of the reactor core even after coolant loss, and control and limit accidents. An important aspect of the control, protection and safety systems is the redundancy provided so that there is no single equipment or system which has to be wholly depended upon and there is backup available should it fail.

Reactor shutdown can be automatically initiated by a number of trip parameters (there are 14 of these at the NAPS) selected in such a way that there are at least two parameters for detecting any serious malfunction requiring reactor shutdown. Triplicated sensors, independent of those used in regulation, are provided for each parameter. For abnormal situations which are not severe enough to warrant total shutdown, there are six parameters which initiate reactor setback, reducing power at the rate of 0.5 per cent per second, using the reactor's regulation system, till the parameter is brought within acceptable limits.

Improved Reactor Design

Since the RAPS-I, the very first CANDU reactor to come up in the country, Indian nuclear technologists have

improved upon the basic Canadian design. Some of the safety-related improvements introduced in the NAPS are:

—Instead of resorting to moderator dumping for shutting down the reactor as in the RAPS and the MAPS, there are two systems provided. The primary shutdown system uses 14 mechanical cadmium rods. The secondary shutdown system, which works independently of the first and is located separately as well, as 12 liquid poison tubes which are filled with lithium pentaborate solution under helium pressure. Each of the two shutdown systems can make the reactor sub-critical in under two seconds by absorbing neutrons and leaving too few for the chain-reaction to be sustained; the moderator dumping took six seconds.

Water Shield

—Instead of the air-filled calandria vault, with the calandria itself surrounded by thermal shields and shield tank, as in the RAPS and the MAPS, at the NAPS the concrete vault housing the calandria is lined with carbon steel and filled with water for shielding purposes. The thermal shields and shield tank are eliminated. This also makes the NAPS the first of the "zero Argon-41" reactors, the absence of air preventing formation of Argon-41, a radionuclide with a long half-life and an important contributor to the radiation dose at the RAPS and the MAPS. The water in the Calandria vault would also dampen vibrations in the event of tremor;

—The NAPS has an integral calandria-end shield assembly, instead of separate calandria and end-shields suspended by support rods as in the RAPS and the MAPS. In the event of an earthquake, this design change would ensure that the different parts of the reactor core vibrated as a single system;

Emergency Control Centre

—There is an Emergency Control Centre, some distance away from the main control room, from where the plant can be shut down, maintained in a safe shutdown condition, and its safety monitored if the main control room is inaccessible for any reason;

—The NAPS has an enhanced Emergency Core Cooling System designed to cool the core adequately following a loss of coolant accident so that the release of fission products from the fuel could be limited and the integrity of fuel channels ensured. When the coolant pressure falls below a certain level, first heavy water and the light water are injected into the core under pressure. This is followed by water from the emergency water storage tank being pumped into the core. Pumps recirculate water spilling from the primary heat transport system after cooling it in heat exchangers.

[6 Feb 89 p 8]

[Text] In addition to the various safeguards to prevent accidents, nuclear power plants have elaborate arrangements for waste management and environmental discharges. In these the plants are required to meet the international standards in vogue.

The International Commission on Radiological Protection (ICRP) has laid down that the public should not receive a radiation dose of over 0.1 rem whole body and 5 rem for any single organ or tissue from both external and internal exposures in a year. The ICRP has also specified the annual limit of intake (ALI) for all radionuclides. From the ALI, derived working limits for allowable concentrations of radioactivity in the air (DWLA) and water (DWLA) are worked out for each nuclear plant, taking into account the environment in which it is situated. (The derived working limits are further apportioned for daily routine releases and occasional short-term high releases in such a manner that the annual dose limit is not exceeded.

But the actual discharges from the Tarapur Atomic Power Station (TAPS), RAPS and MAPS, whether into the air or into the water, have been only a small fraction of the prescribed limits, observes Dr P. V. Gopinath of the Safety Research and Health Physics Programme at the Indira Gandhi Centre for Atomic Research at Kalpakkam. At one kilometre from the plant, the radiation from its operation is just four to six mrem/yr at TAPS and 2 to 5 mrem/yr at RAPS and MAPS, while the natural background radiation in the three places is between 100 and 200 mrem/yr. Further, with the elimination of Argon-41, the dose levels at Narora and future stations will be lower by a factor of five or more, says Dr S. K. Mehta, Associate-Director of the Reactor Group at BARC.

All airborne and gaseous activity from the plant is discharged into the atmosphere only through a 145-metre-tall stack, and that after being passed through high efficiency air filters for removal of most of the particulate radioactivity. Radioactive effluents released from the stack are continuously monitored for inert gas activity, particulate activity, and iodine-131 and tritium levels to ensure that the discharges are within the stipulated limits. After release at that height, the dispersion and dilution by atmospheric mixing bring down the radioactivity to acceptable levels.

Since Narora is an inland site and because it is situated on the banks of the Ganga, particular care has been taken to minimise discharges into the water. Apart from design changes to minimise waste generation, the treatment methods too have been improved. As a result, the radioactivity of liquid discharges will come to only 1.65 Ci/y at Narora, compared to 200 Ci/y at MAPS and 8.6 Ci/y at RAPS. All suspended particles and radio-nuclides with long half-lives such as cesium-137, strontium-90 and iodine-131 are removed. The liquid effluents are

discharged only on a batch basis, each batch being sampled and its activity determined to be within the stipulated limits before discharge. The discharge is further diluted with the one lakh gallons of water per minute blow-down from the cooling towers. The water that ultimately leaves NAPS is potable, says the NPC.

The radioactive sludge left as a result of the treatment is mixed and cast as cement blocks. These are then stored in concrete trenches in the on-site solid waste management area.

The low activity solid wastes are either incinerated or compacted and stored in concrete trenches. The more active solid wastes are stored in specially constructed tile-holes of reinforced concrete with steel lining. The entire solid waste management facility is closely monitored to see that radioactivity remains contained.

But the spent fuel from the reactors is not stored here but kept under water in a special spent fuel storage bay which can take all the spent fuel from 32 reactor years of operation as well as the complete fuel load from one reactor. From here, the spent fuel is transported in 70-tonne lead casks to the reprocessing facility; in the case of NAPS, it will be taken to the power reactor fuel reprocessing facility at Kalpakkam, KARP, is expected to be commissioned in 1990. Most of the radioactivity generated during nuclear power production is contained in the spent fuel and gets released only during the reprocessing to recover plutonium.

These high-level wastes left after reprocessing are mixed with molten glass and cast into high-integrity stainless-steel containers at the waste immobilisation plant (The WIP at Tarapur is undergoing trials, another is under construction in Trombay and a third has been sanctioned for Kalpakkam). These will then be stored for 20 to 30 years in special shielded vaults kept under constant surveillance. The Department of Atomic Energy is casting about for a suitable deep underground geologically-sound repository to which these wastes can ultimately be transferred for permanent storage.

Even with the need for permanent storage of the more radioactive wastes, nuclear waste management does not present insurmountable problems because the waste produced by a nuclear power plant is so small. A 1000 MWe nuclear power plant produces just 50 tonnes of waste in a year (a thermal plant of the same capacity produces 7.5 lakh tonnes of ash in the same period). A 235 MWe nuclear reactor of the sort found in RAPS, MAPS and NAPS produces less than five cubic metres of waste in a year. A publication of the British Atomic Energy Authority pointed out that classified high-level wastes were a "safe and practicable way to isolating the wastes for very long periods under retrievable conditions and required minimum supervision." It went on to add that "the high-level, radioactive waste which would be produced if all the electricity used by an average British family in a lifetime were generated by nuclear power would, in

classified form, be about the size of an ordinary ash tray" (this, it must be remembered, is in spite of electricity consumption per head in Britain being more than 20 times that in India). Immobilisation of high-level waste in a glass-matrix—a technique pioneered by France, a country where nuclear power supplies 70 per cent of the electricity—has been found to contain effectively the very long half-life radio-nuclides present in these wastes.

The nuclear establishment believes strongly that ample precautions have been incorporated in the siting, design, construction and operation of nuclear plants for the protection of the environment as well as of the people at all times. But the anti-nuclear lobbyists are less sanguine. "The problem is that the nuclear accidents which occur are not the ones considered and planned for. Instead, they are complete surprises which wouldn't have been thought possible," remarks Mr Surendra Gadekar, the IIT-trained physicist who edits ANUMUKTI. "Double-containment is not the answer to everything and can be breached in certain accidents."

Such accidents have a probability so low as to be virtually impossible, requiring, as they do, the failure of three or more safety systems, retorts the nuclear fraternity. A DAE paper asserts that "since design basis accidents can be handled by engineered safety provisions in the nuclear power plants, accident management has to be considered as a countermeasure in the unlikely event of an extremely low probability beyond design basis accident situations." But, however improbable they may be, provision is made to meet even such contingencies. Each nuclear plant, before it is commissioned, has to have a detailed emergency plan laying out precisely what the plant authorities as well as the local authorities would do to cope with various situations involving escape of radioactivity which might adversely affect people. How to evacuate, for instance, the local people and provide them with alternative shelter and food has to be carefully planned. The efficiency of this emergency preparedness is tested by conducting mock exercises.

When a nuclear plant is to be set up, an area roughly 1.6 km around it is also acquired and cordoned off as an exclusion zone so that exposure to the public is limited even if there is an uncontrolled release of radio activity. Beyond this is the sterilised zone extending up to five km around the plant where only the natural growth of the population is permitted. This sterilised zone serves to minimise the impact of the station on the public and ensures that emergency actions can be taken to protect the people effectively in the unlikely event of a serious accident.

Even though site selection seeks to minimise natural and manmade hazards, these too have to be allowed for. Earthquakes are a case in point. The Narora station is designed to remain operational even during the sort of earthquake that would probably occur only once during the lifetime of the plant (operating basis earthquake).

Further, even in the worst earthquake likely in the area, all safety systems would be operational and the plant shut down (safe shutdown earthquake).

The Soviet President, Mr. Mikhail Gorbachev, reportedly said that the world economy without nuclear power was unthinkable. His reasoning might well have been that it would require the equivalent of the entire oil output of Saudi Arabia in 1982 to replace the existing nuclear power plants in the world. In India, too, the question may not be whether it can afford to have nuclear power but whether it can afford not to.

Soviet Reactors Lauded

5150097 Madras THE HINDU in English
6 Feb 89 p 4

[Text] Madras, Feb 5. Mr V. Gulko, president, Atomenergoprom, USSR, has asserted that the Soviet VVER-1000 type of nuclear power reactors, to be set up in Koodankulam in Tamil Nadu, have such safety features that make them one of the most reliable of their kind in the world.

The VVER-1000 reactors, were basically different from the RBMK-type of reactors used at Chernobyl, where an accident took place in 1986. What occurred in Chernobyl was impossible with VVER-reactors. The Soviet Union no longer produced Chernobyl-type reactors and RBMK had never been exported, Mr Gulko told the APN.

According to Mr. Gulko, there is a keen interest in VVER-1000 reactors abroad. Already, one VVER-reactor is on line in Bulgaria and work is underway to install more in the GDR, Czechoslovakia, Hungary, and Bulgaria. The Soviet Union has given proper consideration to the concern of the Indian public over the possibility of environmental pollution in south of India as a result of the construction of a nuclear power plant (with two units of 1,000 MW(e) each) there and to the question of safety.

Basis for Future Needs

The VVER-1000 reactors would provide the basis of the Soviet nuclear industry in the near future. The first such reactor with the capacity of 1,000 MW(e) was started up in 1980 at the Novovoronezh nuclear-plant. Today, the VVERs are in place at the Kalinin, Zaporozhye, Balakov, etc.

In developing the VVER-1000, special emphasis is on safety. One major safety feature is a special encasement which can withstand steam pressure even in the aftermath of a breakdown of equipment of the reactor itself, and even the impact of a supersonic jet.

The VVER-1000 is a water-cooled and water-moderated reactor, with the core placed in a thick metal shell with a spherical lid. This arrangement, among other features,

effectively prevents radioactivity leaks as well as enable dependable operation throughout the reactor life. A newly designed earthquake-resistant VVER-1000 could withstand quakes of up to eight points on a 12-point scale. The new reactor also allows the use of sea water for cooling ancillary equipment and can function in a tropical climate, according to Mr Gulko.

Three Barriers

Furthermore, there are three barriers to prevent the spread of radioactivity: sealed shells around fuel elements, heat-transfer circuit and localisation of fission products in limited space. All radioactive water in the reactor-circuit undergo special treatment, radioactive wastes being dumped in special storages. The new material used in building the nuclear-plant preclude a fire and its spread. Electric cables and rooting of nuclear plant premises are made of such material.

Sometimes, nuclear programmes ran into opposition. But the future belonged to the nuclear industry and 21st century will be a century of nuclear power, Mr Gulko said. It was a matter of importance to India, which was improving its economic standing in the world. The nuclear plants were environmentally benign given the normal operation, whereas a 1,000 MW coal-burning electric power station spewed a fairly large amount of radioactive substances every year. The carbon dioxide, sulphur dioxide and nitrogen oxide emitted by power stations running on coal, oil and gas had such an adverse impact on the environment as was impossible in the case of nuclear power plants.

The nuclear power project in Koodankulam made no provision whatsoever for radioactive waste disposal in India. Under the existing arrangement, waste products would be sent to the Soviet Union, Mr Gulko said.

Soviet Reactors To Be Purchased Considered Safe

Writer Gives Details

51500079 Calcutta *THE TELEGRAPH* in English
2 Feb 89 p 6

[Text] The central government has quite expectedly run into some flak for its decision to purchase two Soviet nuclear power reactors of 1000 MW capacity each. In fact, the public controversy that preceded the final decision of this score proves that an increasing number of people are bound to question the wisdom of the powers that be for falling, albeit hastily for such equipment. Not only environmentalists and professionals, but also a large section of the ordinary people are already up in arms against setting up of more high-capacity nuclear power plants in the country in view of the disastrous Chernobyl accident.

Of course, the government and atomic energy officials are trying hard to clear doubts by proffering the rationale behind the action. But how does one get to the real facts?

First of all, attention is drawn to the fact that the reactors India is getting from the Soviet Union are of the VVER-type and not the RBMK-type, the one that was installed at the ill-fated Chernobyl plant. What is more important is that the VVER-1000 nuclear reactor is water-moderated and water-cooled, which is very similar to the pressurised water reactor (PWR) that is in trouble-free operation in such countries as the U.S., France, Sweden, the UK and West Germany.

Some other distinctive characteristics of the VVER and RBMK reactors are that the latter has single containment and is equipped with graphite moderator rods, whereas the former's primary system is housed in a thick-wall metal body with a spherical lid. The VVER-1000 reactor's pressure vessel and primary loops are also made of special low-alloy steel, which provide additional safety not only for the reactor but also a "biological shield" for station personnel.

What should also allay the fear in the minds of many is the fact that India will not be the first country to either "experiment" with or "benefit" from the Soviet-designed VVER-100 nuclear reactor. Such reactors (as many as 25) have not only been successfully operating in the Soviet Union at several stations since 1980 but have also been commissioned in Bulgaria, Czechoslovakia, East Germany and Hungary.

Indian atomic scientists led by the chairman of the Atomic Energy Commission (AEC), Dr M.R. Srinivasan, have made several visits to Soviet power plants which are operating with VVER-1000 nuclear reactors and have fully satisfied themselves with all the aspects of the design functioning and safety. Both Prime Minister Rajiv Gandhi and the minister of state for science and technology, Mr K.R. Narayanan, have also stated in Parliament that the Soviet nuclear reactors are "quite safe."

Some unique features of the VVER-1000 reactors may seem to justify the confidence that the Indian experts and official circles are exuding. In this reactor, important safety devices such as the emergency core cooling system, reactor protective systems and the residual heat removal system, are triplicated. In emergency conditions, each system functions independently for reactor shut-down coolant injection and long-term cooling, thus providing for 300 per cent safety, theoretically.

An essential element of the VVER-1000 reactor's accident-prevention system is a special security dome mounted over the device. It is designed to be able to withstand the pressure of a steamwater mixture even in case the system or the reactor fails—or even if a supersonic jet crashes on the site. Radioactive water circulating in the reactor circuit goes through a special purification process, and radioactive wastes are buried in special dumps.

The VVER-1000 is also capable of withstanding maximum-rated earthquakes up to a magnitude of eight. It provides for using sea water to cool the auxiliary equipment units. This is the reason why the two Soviet reactors are being installed at Koodangulam in Tirunelveli district on the seashore in Tamil Nadu.

Adequate measures have also been provided for minimising, if not altogether eliminating, the danger of leakage in case of accidents. The most important among the numerous barriers for preventing the radiation leakage is a lead-proof room formed by the body and the lid; together with accident-prevention systems it ensures safe operation of the plant. In times of emergency, a highly concentrated boron solution is automatically injected into the reactor core preventing radioactivity discharge.

Of course, an abundance of safety provisions in the VVER-1000 reactor does not necessarily make it an ideal or fail-safe equipment. In fact, no reactor can ever be made absolutely troublefree. But the multiplicity of anti-radiation devices can certainly guarantee against the recurrence of Chernobyl-type mishaps or their consequences, claim the experts.

Specialists also stress that while drawing proper lessons from the Chernobyl disaster, none should ignore the fact that the accident was more due to human error than any major design faults. For instance, Dr Raja Ramanna, former chairman of the AEC, has pointed out: "Chernobyl was more a fire accident and it came about because a young engineer, possibly aspiring for a May Day award, did something very silly by removing the central rods."

But should the Chernobyl, Three Mile and other cataclysmic nuclear plant mishaps prevent mankind from harnessing the full potential of atomic energy? The imperatives of modern times leave energy experts with no choice other than reliance on nuclear power. Fast deceleration of finite fossil fuel resources and meagre generation of energy by alternative sources like sun, wind and tides have aggravated the problem of growing worldwide shortage of energy.

Thus, while the U.S., the Soviet Union, France and Japan have been constructing more nuclear power plants, their experts are sparing no efforts to make nuclear power generation as safe as possible. These countries have in the last few months concluded several bilateral agreements on nuclear power safety even while trying to gain propaganda mileage out of the Chernobyl disaster. Such mutual cooperation has become essential in view of the fact that France now depends on nuclear energy for 69.8 per cent of its need. Japan does so for 30 per cent, the U.S. for 13 per cent, Sweden for 45.3 per cent, West Germany for 39.3 per cent, the Soviet Union for 13 per cent and South Korea for 53.5 per cent. In India, nuclear power generation accounts for less than 1 per cent of the country's total consumption.

Yet, the ranks of atomic energy critics continue to swell day by day. Protagonists of atomic energy continue to strain every nerve to counter the opponents' claim that generating nuclear power portends disaster. They cite the fact that there are now 417 nuclear power stations in 26 countries. They also refer to expert studies made in India and elsewhere to prove that while a thermal power station causes radioactive pollution through its residual coal ash emission, a nuclear power plant is much less ecologically harmful. What is more, the latter provides radio-isotopes for use in medicine and in genetics for development of high-yielding varieties.

India's compulsions for obtaining Soviet reactors were more than one. Firstly, resource constraints impelled India to accept the Soviet offer against a credit of Rs 3,700 crores on easy terms. Another bait to which India could not but rise is the stipulated supply of the necessary quantity of enriched uranium for the entire period of operation of the reactors to avoid the recurrence of the Tarapur experience.

The spent fuel will also be shipped back to the Soviet Union to save India from being saddled with the problem of storage and resultant radiation hazards as had happened earlier on a few occasions. Official experts contend that the arduous method of storage of the spent fuel and its reprocessing to obtain plutonium would not be worth the trouble and be even less economical. Moreover, reprocessing and use of plutonium as fuel would certainly make application of IAEA safeguards for all the Indian atomic stations obligatory.

The wrangle over whether India got the best bargain out of the deal will linger. But it is still difficult to say if India will be in any better position to achieve the target of 10,000 MW of nuclear power generation by the year 2000 even with the Soviet reactors.

No Threat From Koodankulam

51500079 Madras THE HINDU in English
29 Feb 89 p 3

[Text] Madras, 28 January—The life of the community living around Koodankulam village in Tamil Nadu will not be affected by the setting up of two Soviet nuclear power reactors of 1,000 MW capacity each according to Mr V.S.G. Rao, Project Director, Koodankulam Project, Nuclear Power Corporation.

"Agriculture will not be affected... Most of the land to be acquired is uncultivable, barren. Only 5 per cent of the land is cultivable. So it will not be affecting the community living there," he said, while speaking at a seminar on "Why Nuclear Power." The seminar was organised by the Department of Polymer and Environmental Sciences of Madras University, the Department of Atomic Energy and University Students' Advisory Bureau.

Mr Rao said only the uninhabited land within the exclusion zone of two km radius around the plant would be acquired and this area comprised the sea as well. Nor would any of the 15,000 people living in the sterilisation zone, lying beyond the exclusion zone, be evicted. He dispelled apprehensions that much of the fresh water from the nearby Pechiparai reservoir would be used for the project. "We will use a very small percentage of water from Pechiparai reservoir, which has a large capacity. The water we need is 10 cusecs viz 2 to 3 per cent of the capacity of the reservoir. The temperature of the coolant water to be discharged into the sea will not be 5 degrees centigrade above the sea temperature and will not affect fish life," he said.

The first unit at Koodankulam would go critical in 1998 and the second in 1999. The USSR would provide India with 3,000 million roubles of credit for the project. India would start repaying the money after 2001 A.D. in 14 installments at an interest rate of only 2.5 per cent, which was "very favourable." The Soviets would use a lot of Indian contractors and labour even though it was a turn-key project. The project would benefit the people of the surrounding area by generating employment.

No cyclone threat: On the suitability of the site, Mr Rao said it fell under the shadow region of Sri Lanka and would not be affected by severe cyclones. "We have found that a very good rocky foundation is available on the site. We also did seismic studies. There were no faults. It is an excellent site." There would be minimum thermal impact. Waste generation would be limited. The spent fuel would be sent back to the USSR. All liquid discharges would be diluted by the condensed cooling water, which would be sea water. Our dosage will be less than what is permissible. The average dose will not exceed 0.015 milli rem a year for a person—a very insignificant quantity," he said. Any release into the air would be through a 100-metre stack. High efficiency filtering methods would be employed. There would be continuous monitoring of radioactivity and an environmental survey laboratory would be established soon.

Mr Rao also said the VVER-type of reactors to be built at Koodankulam was different from the RBMK-type of reactor at Chernobyl in the USSR, where an accident occurred in 1986. The VVER-reactor was inherently safe. It would automatically shut down if anything went wrong. It had three independent and one back-up shut-down systems. The reactors would use enriched uranium as fuel and light water as moderator and coolant. There would not be any radioactive release from the containment itself. High quality equipment would be used to prevent accidents. "There is no weld in the active core area; no nozzles at the bottom; and the fuel is of high quality," he said. The inside of the reactor vessel would be completely lined with stainless steel. "Every precaution will be taken even for hypothetical accidents," Mr Rao said.

Dr D.V. Gopinath, Safety Research Laboratory, Indira Gandhi Centre for Atomic Research, Kalpakkam, who inaugurated the seminar, said the fear psychosis on nuclear power was due to inadequate knowledge, sensationalism and disinformation on the subject. Nobody claimed that nuclear energy was absolutely safe but no technology was so. India would burn up every source of its energy by 2060 A.D. at its present rate of consumption. Solar and other forms of energy could never prove to be alternatives with the availability of present technology. There was a strong correlation between energy production and health, nutrition, life-expectancy and the well-being of people. Hence, nuclear power was the only alternative.

The Madras University Vice-Chancellor, Dr A. Gnanam, said that while the per capita consumption of energy in the country was only 200 units equivalent of electrical energy, it was 1,200 units in the developed world. Nuclear energy was needed to improve the quality of life when the availability of coal and fossil-fuel was depleting.

Dr M.A.R. Lyengar, head of the Environmental Survey Laboratory, Kalpakkam, said there was no radiation-free environment. Radiation was a basic fact of nature. The radiation-levels after the two units at Kalpakkam started operating from 1983, were consistently low.

Mr N.Rajasabai, Madras Atomic Power Station, Kalpakkam, who explained the working of the two reactors said decommissioning a nuclear power plant posed no problem and technology was fully available for it.

Mr A.R. Sundararajan, IGCAR, Kalpakkam, said that while a person living in the vicinity of a nuclear power plant would receive two to five milli rem of radiation, a single X-ray could provide a man with 20 milli rem.

Mr R.V. Amalraj, Central Waste Management Facility, Kalpakkam, said the general approaches to waste management included identification and separation, reduction and utilisation, transport and treatment, and disposal and surveillance.

Prof. H. Kothandaraman, Madras University, said the aim of the seminar was to educate the students on various aspects of nuclear power programme. Mrs Sushila Mariappan, secretary, University students' Advisory Bureau, proposed a vote of thanks.

Study Notes Waste Can Be Reprocessed as Fuel
51500098 Madras THE HINDU in English
3 Feb 89 p 10

[Text] Bombay, Jan. A number of nuclear reactor byproducts considered "nuclear waste" by the scientific world, can be re-processed and used as power reactor fuel, according to a study by the Bhabha Atomic Research Centre (BARC) here.

A considerable amount of the byproducts—special actinide elements, comprising neptunium, americium, curium and californium—have accumulated in the spent fuel of power reactors over the years since the discovery of fission. These alpha-active nuclides, having half lives of thousand years or more, are generally looked upon as "waste" and are marked for disposal in deep soil along with 'high level' fission product waste.

A Landmark

The study, regarded as a landmark in the understanding of nuclear physics, has been carried out by the Neutron Physics Division (NPD) of BARC by computing afresh the criticality parameters of several fissile and fissionable isotopes of actinides.

The research stresses that the criticality values of both fissile and fissionable special actinides are systematically higher than those of the commonly accepted fuel material uranium and plutonium.

The study raises the question whether special actinide nuclides should still be efforts to "fix" and bury them underground and then keep worrying about their long-term radiological hazards.

When the reactor grade plutonium along with the higher mass isotopes can be treated as valuable fuel materials for both fast breeder and thermal reactors, inclusive of light water reactors, "it is clear that based on reactor physics considerations alone, there is no justification to treat the special actinides as waste," the study observes.

Valuable

The objective of this work, carried out by Dr M. Srinivasan, Dr K. Subba Rao, Dr S. B. Garg and Dr P. K. Iyengar, (the extended abstract was submitted to the American Nuclear Society and accepted recently) was to draw the attention of the nuclear world to the fact that every one of the special actinide nuclide, irrespective of whether it has odd or even neutron number, is a more valuable nuclear fuel than the corresponding isotopes of plutonium.

So far, only Uranium-235, U-233 and Plutonium-239 have commonly been considered as fissionable material. However, it is now known that every transuranium nuclei having an odd number of neutrons in the nucleus is also fissionable (can sustain a chain reaction).

The scientists pointed out in their study that it was not commonly known that the even neutron nuclides (which are fissionable only by fast neutrons having energies above their fission thresholds) are also surprisingly capable of independently sustaining fission chain reaction.

Meanwhile, because of the attractive criticality properties of odd neutron nuclides, they have been considered for special applications such as space power generators and interplanetary rocket propulsion.

"Wide recognition and acceptance of the special actinide material as a potential nuclear fuel rather than as long-live alpha active waste would help eliminate at least one of the negative aspects of nuclear fission energy from the public point of view," the scientists observed.

The study will be presented on April 28 this year at the golden jubilee celebration of fission by the American Nuclear Society, and later in July at a meeting in West Germany.

IRAN

Arms Deal With China Reported

NC2903111489 Paris AFP in English 1041 GMT
29 Mar 89

[Text] Abu Dhabi, March (AFP)—Iran will launch a communications and reconnaissance satellite on a Chinese rocket under a deal signed recently, the United Arab Emirates (UAE) AL-ITTIHAD newspaper reported Wednesday.

The paper, quoting unnamed European diplomatic sources, said Tehran had signed a "major" arms deal with Beijing which provided for building an Iranian satellite to be put in orbit by the early 1990's.

The satellite will be used for communications and reconnaissance purposes, the paper said, stressing that the deal was separate from an earlier Iran-China accord.

Under the earlier deal, China was to supply Iran with jetfighters, 40 Silkworm surface-to-surface missiles and eight batteries of surface-to-air HQ-2 missiles which are similar to the Soviet SAM-2 missiles.

It will also provide spare parts for medium range surface-to-surface Scud missiles and a submarine to be delivered this year, AL-ITTIHAD said, adding that Iranian Airforce pilots would also train at the Shanghai air academy.

According to the report, Iran was expected to spend around 10 billion dollars over the next five years on its defense program.

IRAQ

Development of Missiles With Brazil Planned

36990006 Rio de Janeiro O GLOBO in Portuguese
19 Mar 89 p 46

[Text] Sao Jose dos Campos, Sao Paulo—Over the next few years Brazil and Iraq may join in a wide-ranging program of scientific and technological cooperation to train Iraqi engineers and researchers and to develop aircraft, rockets, satellites, and weapons.

Negotiations are now beginning. They involve the Brazilian Air Force, the Ministry of Foreign Relations, Embraer [Brazilian Aeronautics Company], Orbita Aerospace Systems, Engesa [Specialized Engineers, Inc.], the Aerospace Technology Center [CTA], and the National Institute of Space Research [INPE].

As of now, the most promising part of the program is the joint development of satellites and missiles. The remote sensing satellite, expected to be developed using INPE's technology, will have civilian and military applications. The terms of the agreement, however, have not yet been defined. Iraq is also interested in acquiring technologies relating to rockets and missiles capable of launching satellites, and is disposed to finance part of the Brazilian space program in exchange for the technology.

The initial understandings relating to this cooperation were reached last December when a contingent from the Brazilian Air Force visited the various Arab countries. Shortly thereafter, the Iraqis consulted with Major General Hugo de Oliveira Piva, a former director of CTA and of the R&D division of Orbita Aerospace Systems.

Hugo Piva did confirm that an initial understanding was reached with Iraq relating to a satellite program. He added, however, that the idea has not evolved further because INPE must first discuss the matter with the government before negotiations between the two governments can begin. INPE's director, Marcio Barbosa, is aware of the proposal, but he prefers to wait for additional contacts with Gen Hugo Piva so that documents relating to the matter can be exchanged.

ISRAEL

'Careful Monitoring' of Iraqi Reactor Promised
TA2803114189 Jerusalem THE JERUSALEM POST
in English 28 Mar 89 p 1

[Report by Menahem Shalev and Elaine Fletcher]

[Excerpt] Official Israeli sources yesterday confirmed that Saudi Arabia has offered to finance the rebuilding of the Iraqi nuclear reactor destroyed in the 1981 Israel Air Force raid.

The fact that the rebuilding of the plant was announced publicly by President Saddam Husayn earlier this week could also carry a political message for Iran and Israel.

The sources added, however, that it is still unclear whether Baghdad has taken or will take any practical steps to obtain a nuclear weapons capability.

A senior official told THE JERUSALEM POST yesterday that Israel is carefully monitoring Iraqi intentions. He said that if Iraq once again embarks on a nuclear course, Israel would likely inform the U.S. of its grave concern and warn Washington of the "negative consequences."

Because of Iraqi use of chemical weapons in the Gulf War, and the potentially destabilizing effect of an Israeli preventive action, the U.S. would most likely take "forceful measures" to dissuade Iraq from rebuilding the reactor, the official said. [passage omitted]

Threat to Iraqi Reactor Alleged

JN0104115189 Kuwait AL-RA'Y AL-'AMM in Arabic
30 Mar 89 p 1

[Text] Paris—Western sources have told AL-RA'Y AL-'AMM that Israel is watching with great concern and consternation Iraq's efforts to rebuild and reactivate the nuclear reactor which the Israeli planes destroyed 8 years ago. The French sources explained that Israel informed France that it has information confirming that Iraq started to rebuild its nuclear reactor only a few months after its destruction and that several Western states contributed toward rebuilding the reactor despite their realization that reactivating the reactor constitutes a serious and real threat to Israel's safety and security.

The sources noted that an Israeli memorandum to this effect indicated that Israel cannot accept this situation and might find itself compelled to destroy the reactor again at the appropriate time and before it begins the production stage.

The French sources said the Israeli Government made extensive secret contacts with a number of states, including the United States, giving them the information available to it concerning the rebuilding of the Iraqi nuclear reactor, and asserting it will not wait long before destroying this reactor once again.

Iraqi Nuclear Capability 'Highly Exaggerated'
TA0304092489 Tel Aviv DAVAR in Hebrew
3 Apr 89 p 1

[Report by military correspondent Tali Zelinger]

[Text] Senior military sources believe that the foreign press reports on Iraq's developing nuclear capability are highly exaggerated.

Although Major General Ehud Barak, deputy chief of staff, said yesterday, in response to a question about this, that "there is certainly a grain of truth in this report," it appears that a timetable of 1 to 2 years for the time it would take to make the Iraqi reactor operational is inexact and exaggerated. It has nevertheless been learned that Iraqi efforts to achieve nuclear capability through the services of knowledgeable, but unofficial, elements from West Europe and other countries are under way. Israel is closely following these developments, as well as the development and production of Condor missiles, advanced long-range surface-to-surface missiles, but the assessments here are also conservative.

Deterrence Best Answer to Missile Threat
TA0304115689 Tel Aviv HA'ARETZ in Hebrew
3 Apr 89 p 11

[Commentary by Re'uven Pedatzur: "Investing in Deterrence"]

[Text] The addition of surface-to-surface missiles of impressive quality in massive quantities to the arsenals of the Arab countries has, to a large extent, changed the concept of those involved in the regional conflict with regard to the balance of power between Israel and its neighbors. This mainly refers to Israeli decisionmakers and senior military officers, who recently began to give high priority to the existence of missiles on the other side of the border, which threaten not only the Golan Heights, but also the center of Israel.

After studying remarks by the defense minister, the chief of staff, and Israel Defense Forces [IDF] generals, it appears that in their evaluation, surface-to-surface missile procurement by the Arab countries erodes Israel's military superiority, and the potential use of the missiles creates threats that Israel did not face in the past.

It seems, as the leaders of the defense establishment admit, that Israel does not have the military means to neutralize the missiles once they have been fired at targets in Israel.

After analyzing the threat to Israel, the British military affairs weekly JANE'S DEFENSE WEEKLY determined that Israel had decided to change its military strategy by participating in the U.S. Star Wars project.

The weekly is referring to the development of the Arrow antimissile missile by Israel Aircraft Industries [IAI]. The Israeli military answer to the Arab surface-to-surface missile, according to JANE'S, is procurement of a weapons system capable of downing enemy missiles.

In presenting the change in Israeli strategy this way, the British weekly made two mistakes: First, the operational concept on which the Arrow is based was developed by IAI according to U.S. Administration demands and not IDF operational demands derived from a change in military doctrine.

Second, the defense establishment does not intend to finance the Arrow project in the foreseeable future.

The overall cost of this project is several billion dollars, and General Staff officers have already made it clear that, in a period of military budgetary cuts, such large sums cannot be diverted for the purchase of a weapons system to down enemy missiles.

"Surface-to-surface missiles dispatched at civilian settlements," senior officers claim, "never determined the outcome of a war. Their main damage is to the morale of the civilian population."

All the above is certainly correct, but it provides only part of the overall picture. It is obvious that the existence of long-range missiles capable of highly accurate hits on almost all strategic targets in Israel is a military problem of the highest order.

That is why the IDF cannot ignore the military aspect of the missile race in the region and must provide suitable answers to the growing threat.

In the final analysis, the IDF is basing its answers to the Arab surface-to-surface threat on three levels:

- the Air Force's capability to carry out raids deep in enemy territory.
- the development of early warning systems against the dispatch of missiles toward Israel.
- deterrence.

It is no secret that the Air Force is capable of attacking the missile launching bases in the Arab countries, even those deployed deep in the rear. This military solution, however, has two main limitations. One is cost. It should be assumed that the launching sites will be defended by highly concentrated and varied anti-aircraft systems. The Air Force would have to pay a heavy price for its success. The second limitation is even more serious: In order for the missiles to be destroyed before launch, the Air Force has to be given the attack order even before a war has started. That means that this solution increases the possibility of an Israeli-initiated first strike, with all the political repercussions involved.

Another solution, to which Chief of Staff Dan Shomron referred in the lecture he gave several weeks ago at Tel Aviv University, is the building of an early warning system that would provide the rear guard with information on a missile launching only minutes before they hit their target. This would be part of a defensive strategy.

This is a slightly hard-pressed solution that might save lives, but would not prevent an attack on military installations and the disruption of the IDF's activities. According to the chief of staff, the warning system would provide information on the missile and its path.

It seems that the most effective answer continues to be, as in the past, deterrence. The Arab leaders' fear of an Israeli attack if they dare to use surface-to-surface missiles has the best chance of preventing Al-Asad, or even Saddam Husayn, from ordering the launching of missiles at Tel Aviv or Haifa.

The state of Israeli deterrence is based to a large extent on vague information at the disposal of the IDF. Israel has never confirmed that it has the Jericho surface-to-surface missile, but reports on tests carried out on the Jericho-2 over distances of 820 km were widely published in July 1987. The launching of Ofeq-1 has aroused speculation that Israel has a medium-range ballistic missile.

Israel has not changed its military strategy with regard to the Middle East arms race, but the message sent across the border is unequivocal: We are capable of making you pay so dearly for the launching of missiles against our rear guard that any such decision would be irrational.

PAKISTAN

West German Firms Said Assisting Bomb Efforts
51004706a Manama GULF DAILY NEWS in English
19 Feb 89 p 2

[Text] West German firms have helped Pakistan for years in its efforts to build an atomic bomb by supplying it with "made-to-order" spare parts and technology, a report claims today.

The West German magazine DER SPIEGEL says the assistance was being offered to Pakistan, which has not signed the nuclear non-proliferation treaty, with the Bonn administration's consent.

The Federal Economy Office (BAW) at Eschborn authorised delivery of an electronically-controlled milling-machine to Pakistan, it says.

American experts said it could be used to producing mock-ups for building elements of an atomic bomb", according to DER SPIEGEL.

BAW also allowed export of a special press for compressing hard metal to form powder that could be used to make the heavy metal core of projectiles, it said.

The Karlsruhe Nuclear Research Centre (KFK), which is 90 per cent government owned, was also involved in the transactions with Pakistan.

It had delivered parts of mass spectrometers for training Pakistani nuclear researchers, the magazine said.

Negotiations for French Nuclear Plant Reported
51004706b Manama GULF DAILY NEWS in English
25 Jan 89 p 16

[Text] Islamabad: Negotiations were continuing between Pakistan and France for the purchase of a French nuclear power plant to offset the country's energy shortage, a foreign office spokesman here said yesterday.

Reiterating Pakistan's resolve to acquire nuclear energy for peaceful purposes, he said the plant required from abroad will be subject to international safeguards. But there has been no agreement with France so far, he said.

Pakistan floated international tenders in 1982 for the purchase of a cluster of light-water 900-megawatt capacity nuclear power plants to be installed at Chashma in the Punjab, alongside a nuclear reprocessing plant France had agreed to supply in 1976.

The latter deal was unilaterally scrapped by France under U.S. pressure, though Pakistan continues to urge France to honour the commitment.

Pakistan has received no bids for its Chashma complex, though reports here said France had expressed an interest in settling the ongoing dispute.

Pakistan went to the International Chamber of Commerce and Industry to force France to honour the deal. Its claim, worth millions of dollars in compensation, was upheld, but Paris reportedly wanted to settle out of court.

Observers here expected an agreement might be possible before President Francois Mitterrand's expected visit to Pakistan in September this year.

Scientist Says Reactor Capability Achieved
BK2303102789 Lahore JANG in Urdu 14 Mar 89 p 1

[Text] Islamabad—Pakistan has the capability to build nuclear reactors to meet its energy requirements. Whenever the government asks for it, we will fulfill this obligation. This was stated by the eminent scientist, Dr Abdul Qadeer Khan, while talking to a JANG correspondent at a function when his attention was drawn to the fact that the United States, Canada, the United Kingdom, and other developed countries have shown no interest in providing a nuclear reactor to Pakistan even after the issue of an international request in this regard. Replying to a question on whether the reactor can be completed in 10 years, Dr Qadeer Khan said that we will build the reactor well before the estimated time.

Rocket Manufacturing Program Continues
BK2103052689 Islamabad Domestic Service in Urdu
0200 GMT 21 Mar 89

[Text] Pakistan has manufactured several types of rockets which can carry scientific equipment to considerable altitudes. The SUPARCO [Space and Upper Atmosphere Research Commission] chairman has said in Islamabad that the rocket manufacturing program continues and a powerful booster will be tested this year for launching heavy scientific equipment into upper space. The objective of the program is not only to conduct experiments in space but also to launch light satellites into suborbital flights.

Booster Rocket Developed for Satellite Launcher
BK2103147089 Hong Kong AFP in English
1354 GMT 21 Mar 89

[Text] Karachi, Pakistan, March 21 (AFP)—Pakistan has manufactured a rocket booster as the first stage of a planned multi-stage launching system that will put a Pakistani satellite in a low earth orbit.

Selim Mehmud, chairman of the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) said here Monday that the booster had been designed and built by Pakistani scientists without any foreign assistance.

The official news agency APP said the booster would be test fired by mid-summer or early autumn. Its range is reported to be 400 miles (640 kilometres), similar to that of a rocket test-fired at a beach near Karachi in January.

SUPARCO had earlier announced that the first Pakistan-made satellite was ready for launching. Officials said that it would be put in orbit in collaboration with a Western nation in about a year.

APP quoting informed sources said that SUPARCO scientists were also working to manufacture the propellant fuel needed to power the satellite rocket booster. It said that SUPARCO was forging ahead with its space research programme on the basis of self-reliance, and the development of an independent multi-stage satellite launching system was a part of the programme.

Meanwhile, the mass circulation Urdu daily JANG reported Tuesday that Pakistan has developed a surface-to-air missile with a range of up to eight kilometres (five miles). There was no official confirmation of the report.

Commentary Urges Nuclear Self-Reliance
51004706c Islamabad THE MUSLIM in English
24 Feb 89 p 3

[Article by Sarfaraz Hussain: "Reagan's Parting Kiss"]

[Text] The dilemma of Pakistan's foreign policy has always remained a "disproportionate tilt" in favour of U.S.. Unfortunately, the past regimes, against the aspiration of their people, relied more upon U.S. goodwill and friendship with a view to consolidating their weaker position. Most of the rulers, being "more loyal than the king" followed a policy of "antagonism" towards Soviet Union which caused great harm to Pakistan rather than achieving any substantial benefit out of it.

While formulating the country's foreign policy, two factors remained predominant in the minds of the policy makers. Firstly, the Indian factor which may be attributed to a psychological state of mind where the inherent apprehensions and fear of India, and secondly the Indo-Soviet designs in South Asian region that now force a militarily strong Pakistan rather than a politically and economically viable country. As far as Indian factor is concerned, it will continue to dominate Pakistan's foreign policy till such time both Pakistan and India accept political realities in the region and the world at large.

The second factor relates to legitimacy. It may be seen through events that all dictatorial regimes in their political and economic failures sought refuge in the U.S., who, in some selective cases, was not only instrumental

in perpetuating the undemocratic rule but to a great extent responsible to give specific shape to Pakistan's foreign, economic and defence policies. Such an influence and trend unfortunately, still goes unabated in Pak-U.S. relationship even after restoration of a democratic regime in the country.

In May 1974 India had exploded its first nuclear device, sending a wave of shock to all the countries of the region in general, and Pakistan in particular. Pakistan in its bid to reduce the psychological impact announced to take full cognizance of this serious development and decided to speed up its slow paced nuclear programme to revive confidence of Pakistani nation who, back in 1971, had greatly suffered in the hands of India.

Since 1974 an intense propaganda campaign was launched by India and Zionist-controlled media against Pakistan's peaceful nuclear programme. In spite of the facts that Mr Bhutto was ousted from his office through a military take over and was subsequently, executed, the U.S. administration was not satisfied till such time the Pak-French deal for supplying a nuclear reprocessing plant was not got cancelled. [sentence as published] It is interesting to note that even after the installation of a regime more acceptable to U.S., the misconception and propaganda against "Kahuta" was not stopped by India and its U.S. supporters. Echo of a joint Indo-Israeli air strike against Pakistan nuclear installations was often sounded in international media. Pakistani scientist and diplomats were repeatedly accused of stealing nuclear secrets. Some Muslim heads of states, particularly Col Moammar Qaddafi, was vehemently, blamed for causing "terrorism" through financing Pakistan's nuclear projects.

Pakistan apologetic explanations, in spite of all its assurances were viewed as unconvincing and a mere "cover up". In 1981 Pak-U.S. relations touched its lowest ebb on nuclear issue. During this period U.S. decided to counter Soviet influence and to intervene in Afghanistan's affairs, in a big way. Therefore, Pakistan, a "defaulting case of nuclear proliferation" was suddenly re-discovered as a "front line state" whose security and integrity was a "cornerstone of U.S. foreign policy". A U.S. aid package of 500 million dollars viewed as "peanuts" by Pakistan was immediately enhanced to 3.2 billion dollars, without subjecting it to the rigidity of "Smington" bill. This was followed by yet, another package of 4.02 billion dollars. To use this country as a conduit for arms supplies to Mujahideen all propaganda against Pakistan's nuclear programme was toned down. Reagan administration throughout, maintained and certified to congress that Pakistan's nuclear programme was peaceful and it was not producing any nuclear bomb.

Surprisingly, it was only at the eve of President Reagan's departure from White House that a deliberate leak to "Washington Post" has once again caused a replay and resurfacing of Pakistan's nuclear issue, triggering doubts about U.S. intentions in honouring its promised aid

package, particularly, at a time when the settlement of Afghanistan problem is very much in sight. According to "Washington Post" report, Reagan administration had informed the congress that U.S. may not certify that Pakistan's nuclear programme was peaceful and that it was closed to acquiring capabilities to build a bomb.

It may be observed that the timing of this "wonderful" leak is not only interesting but this "Parting Kiss" of Mr Reagan also cannot certainly be viewed as without deep significance. On the one hand this leak amounts to serve as a notice on Benazir's government, still in its infancy, to change its consistent stand over the nuclear question. On the other hand it may sound as warning to the daughter of Zulfikar Ali Bhutto to give up any future ideas to hob-nob with the Soviet Union after the withdrawal of Soviet troops from Afghanistan. It can also be construed as a not so [words illegible] to give a shaky start to the new administration of George Bush in the future Pak-U.S. relationship.

Pakistan, in spite of its sincere pledge against acquiring a weapon oriented nuclear programme has still not been cleared by the U.S. at the behest of strong Indian

propaganda and Zionist lobby. Under such a perception an average Pakistani, anywhere living in the world, is of the opinion that after having all these false accusations levelled against Pakistan even, the physical assassination of its leaders on this issue, Pakistan must not abandon its nuclear programme.

After having won country's general elections and with an appropriate representation in all the four provinces, present regime of PPP, as compared to any other political party, is in a better position to take some major decisions on the country's foreign and economic policies. There are no permanent friends or enemies in politics of a nations. Likewise, there is no reason for U.S. to continue aid without "string". It is time to grow out of the fear of suspension of U.S. aid and to seek self-reliance after evolving comprehensive policies and to draw correct national priorities so that country's long outstanding political, social and economic problems which hitherto, remained subjected to adhocism and personal whims of a few individuals can be resolved and the dream of a strong and prosperous Pakistan can become true.

New Standards for Contaminated Chernobyl Areas Set

LD2303133789 Moscow TASS in English 1230 GMT
23 Mar 89

[Text] Minsk, March 23 (TASS)—The Belorussian Government has adopted new residential and economic standards for areas contaminated after the April 1986 Chernobyl nuclear power plant accident.

The norms set a lifetime ceiling of 35 REMS (Roentgen Equivalent Man) for people in the contaminated areas.

The amount of permissible radiation per person will be counted assuming that the person was born or moved to the area in childhood in 1986-1989 and will spend all his life, 70-75 years, in the area.

Limitations on living and using local products on territories with cesium-137 contamination levels of less than 15 curie per square kilometre will be lifted because people living in these areas will not receive the top permissible radiation dose, experts believe.

In areas with higher contamination levels decontamination will continue. Local foods will remain banned.

There are 20 villages in Belorussia where radiation levels over a lifetime may exceed the 35 REM limit and if decontamination fails to decrease the levels, residents will be evacuated.

"Before setting these standards officials consulted prominent foreign experts, many of whom think that the dose is too low and could have been raised to 50 REM in one lifetime", academician Leonid Ilyin, vice president of the USSR Academy of Medical Sciences and a noted expert in radiology, told TASS.

"In the first days after the accident part of the population, mostly children, had their thyroid glands exposed to radioactive iodine. In some areas iodine preventive treatment came too late and with lesser effect. Some people might suffer from enlarged thyroids seven to eight years after the accident. Most growths will be benign but there is also a very small possibility of malignancies two to three years later."

Ilyin called for scrupulous medical monitoring of children who had been exposed to iodine radiation to prevent possible complications.

Group Demands Ban on Kazakhstan Nuclear Tests

LD2203085789 Moscow TASS in English 0820 GMT
22 Mar 89

[Text] Alma Ata, March 22 (TASS)—The first donations came in today to account 700844 which had been opened by the "Nevada" public movement in Kazakhstan, a Soviet Asian republic.

This new public organization is aiming to secure an end to the production and testing of nuclear weapons and a ban on underground nuclear explosions on the territory of Kazakhstan. Olzhas Suleimenov, a prominent poet, a deputy of the USSR Supreme Soviet, had been elected the organization's chairman.

"The world associated a good deal of hopes with the Soviet nuclear tests unilateral moratorium announced in 1986 by Mikhail Gorbachev, general secretary of the CPSU Central Committee," the poet told TASS correspondent.

"The Kazakhstan steppe had a year-long respite from the ruinous experiments. Throughout the period my fellow countrymen, just as all ordinary people around the world, hopefully waited for a response from across the ocean. However, the only thing we heard was the echo of Nevada nuclear detonations."

"This is why the Kazakhstan public organized a movement for an end to nuclear tests in the area of Semipalatinsk. It has been given the name Nevada. Thereby we want to emphasize that we shall be able to attain our goal only with support from U.S. peace forces. All peoples would benefit from that. I am calling on the Americans to direct the entire power of their social influence towards banning nuclear tests in Nevada."

Alzhas Suleimenov said the participants in the movement came forward with demands to close nuclear test sites down, to begin work to phase out the plants which produce nuclear materials for military purposes, and to carry out public inspections of stations for the dumping of radioactive wastes.

FEDERAL REPUBLIC OF GERMANY

ABB, Siemens To Build High Temperature Reactor in USSR

M1890130 Berlin ETZ in German

No 24/88, Dec 88 pp 1142-43

[Text] Asea Brown Boveri AG (ABB) and Siemens AG's nuclear engineering division have signed a general agreement for industrial cooperation on planning and building low output, high-temperature reactors in the Soviet Union. The Soviet partner is the Central Atomic Energy Administration (Glawatomenergo), which reports to the State Committee for the Exploitation of Atomic Energy (GKAЕ). The agreement was signed in Moscow on 24 October.

In the first phase of the agreement a large-scale prototype plant with a modular high-temperature reactor (HTR) providing a 200MW thermal output will be jointly planned and built at the NIAR nuclear research center in Dimitrovgrad, about 800 km east of Moscow. Plans are also in the works to build additional plants to produce electricity, process steam and/or process heat both in the USSR and in other countries.

Working together as a consortium, ABB and Siemens' nuclear engineering division will supply materials and services with a yet to be established value for the planning and building of the Dimitrovgrad HTR. Agreements with the Soviet partner on planning, supplies, and assembly, as well as on a license contract, will settle the details.

The large-scale prototype plant to be built in Dimitrovgrad will be run at 700° C to 750° C for the first few years, after which there are plans for conversions to increase the plant's operating temperature to 950° C, to demonstrate high temperature process heat generation for the chemical industry and coal gasification. In the near future both sides will carry out joint R&D for this purpose as part of a project in which the Juelich Nuclear Research Facility and the GRS [Reactor Safety Society] will also participate. This research and development program follows the goals set out in the agreement signed on 22 April 1987 between the FRG Ministry for Research and Technology (BMFT) and the USSR State Committee for the Exploitation of Atomic Energy on scientific and technical cooperation in the non-military use of nuclear energy.

ABB and Siemens' nuclear engineering division see this as an important element in the cooperation developing between the FRG and the USSR on non-military use of nuclear energy. The construction of a pebble-bed HTR in the USSR, similar to those that have been under development in the FRG over the last 30 years, is seen by the FRG partners as a milestone in this progressive technology. This should provide an impetus for the future introduction of HTR's on a commercial scale in both the

USSR and in other countries. This contract also constitutes a long-term safeguard for the know-how gained over many years of work on high-temperature reactor planning and building. This knowledge is thus preserved for further exploitation in both the industrialized western countries and in other countries. The approval of the Coordinating Committee on East-West Trade (COCOM) must, however, be granted before substantial HTR technology can be exported.

State Prosecutor Investigating Technology Transfer

LD0204173489 Hamburg DPA in German

1550 GMT 2 Apr 89

[Text] Bielefeld (DPA)—The Bielefeld State Prosecutor's Office still has to investigate whether the Gilde-meister Company has committed an offense under the foreign trade law. State Prosecutor Heinz Hense confirmed in response to an enquiry. At present they are examining whether the sale of equipment to Iraq is subject to authorization, and if so whether this was granted, the Bielefeld State Prosecutor's Office spokesman said.

Bonn Initiated Trade Investigation, Iraqi Link

LD0304153589 Hamburg DPA in German 1413 GMT

3 Apr 89

[Text] Bonn (DPA)—According to information from the Economic Affairs Ministry, the Federal Government itself initiated investigations by the state prosecutor's office against some German firms on suspicion of being involved in the construction of a secret military research and development center in Iraq. Thus the ministry spokesman confirmed in Bonn today the report in the news magazine STERN, which became known on the weekend. The ministry spokesman would make no comment on the current state of the investigations.

"A series of foreign trade checks" preceded the investigations, the spokesman said. In his words it is still at present unclear whether in the research center in question there was a plan to develop nuclear warheads. The questions of whether FRG firms are also involved could not be answered by a spokesman of the Federal Finance Ministry.

The management of the Bielefeld company Gildemeister Projecta confirmed today that the Bielefeld state prosecutor's office is investigating the firm for possible violations of the foreign trade law. On 20 March offices were searched and documents were confiscated. The firm itself (a subsidiary of the machine-tool company Gildemeister AG) stated that it supplied laboratory and workshop equipment "for universal use" to Iraq for the project "Sa'd 16" and installed it there.

Official licenses were granted for all these exports, the management said. The equipment was not produced especially for military purposes. It was not suitable for

nuclear technology. According to the STERN report, the companies of Messerschmidt-Boelkow-Blohm (MBB), Siemens, and the Rheinmetall subsidiary, Aviatex, are also said to be involved in the Iraq deal.

Firms Involved in Iraq Missile Production

AU2803141889 Hamburg DER SPIEGEL in German
27 Mar 89 pp 170-173

[Unattributed report: "Everything Completely Harmless"]

[Text] Iraq is building its own missile production. Technology and know-how for the research center were delivered by German companies.

On 5 August 1987 at 1602 telex machine "298078 Con MIK" starts to rattle. Telex number 3368 goes "To Gipro site office" and starts with a call for help:

"Since at the moment it is hardly possible to reach a competent person at project Saad 16," the "very esteemed gentlemen" Nitsche and Isele are asked to convey the "list of training companies with the relevant dates of the courses."

The telex line belongs to the Vienna Consultco Limited. In Al Thakafiya Street [spelling as published] in the north of the Iraqi university town of Mosul this Austrian construction company has a joint office with the Bielefelder Gildemeister Projecta Limited (Gipro).

Gipro is the general contractor for Saad 16—a project for which "laboratories and workshops comparable with facilities for technical colleges and test institutes" are being built, according to the Gipro management.

The comparison is misleading. In reality Saad 16 is the currently largest and most secret armament project in Iraq. Documents and eyewitness reports available to DER SPIEGEL are substantiating the suspicion: The facilities being constructed on the northern rim of the town on the Tigris River are certainly not the harmless institute that "is to be operated in cooperation with Mosul University," as the Gipro management claims.

Telex number 3368 proves: German companies are involved much more in the project than has been assumed to date.

Dozens of FRG companies have delivered technology and know-how for the "Technology Center," in which—according to intelligence information—missiles and chemical weapons are to be developed. The Iraqis are basing their work on preliminary work done by Egypt and Argentina—the Condor 2 missile project. Its goal is the development of a precise intermediate-range missile whose range could cover the entire Middle East.

The beneficiary of FRG business efficiency is a dictatorship, which is striving for regional supremacy after 8 years of war in the Gulf, which tried to break the resistance of its own Kurdish minority in the north of the country with cowardly poison gas attacks in violation to international law, and which has recently been accused by the human rights organization Amnesty International of systematically torturing even children.

A structural diagram from the documents of a company involved in Saad 16, which was published in the previous edition of the Austrian magazine PROFIL, proves FRG influence on the DM1.5-billion project: According to this, 5 years ago the state-owned Iraqi company Saad General Establishment contracted Gildemeister Projecta in contract number 16/1/84 as the general contractor for "technology" and Consultco as subcontractor for the "civilian parts" of the project—overground workings and foundation work as well as transportation and insurance.

The most important deliverer of technology of the planning company Gipro became Messerschmidt-Boelkow-Blohm (MBB), a Munich aircraft company, which has been developing various kinds of flying armament for decades—from the Tornado fighter bomber to the Fighter 90, from antitank missiles to large-scale missiles. MBB is participating in the Mosul deal with DM77 million. The people from Munich and Bielefeld hired several other subcontractors. "As a German company," the Gipro management assured DER SPIEGEL, "we tried to contract German producers for the delivery of equipment if it was possible in any way." Obviously with success.

From the German BP to Carl Zeiss, from Degussa to Tesa—renowned companies are working for the Saad 16 project: 38 FRG companies are dealing with a comprehensive training program for Iraqi experts, which are to be trained in operating chemical laboratories and electronics workshops, wind tunnels, and physical test facilities.

The list of contractors in a monthly Gipro report also contains companies which have repeatedly been suspected of dubious arms deals.

Fritz Werner Industrial Equipment Limited provided a universal drilling machine. The company from Geisenheim, which is 10-percent state owned has been conducting profitable arms deals for years, also with Iran, Iraq's enemy in the Gulf war.

By far, the most comprehensive monthly delivery in July 1987 was ordered at Karl Kolb Company. The public prosecutor is currently investigating this laboratory equipment company because of the suspicion that the Hesse firm delivered poison gas facilities to Iraq.

The Rheinmetall cannon production company is involved via its subsidiary Aviatest, providing two wind tunnels; and with the Mauser gun manufacturer another FRG arms producer is listed in Gipro's order books.

There is even a direct missile trace from MBB to Iraq, which has now been retraced by PROFIL journalists Herbert Langner and Alan George. The Munich company has been involved in the Argentine Condor I Project since 1979, which first was allegedly destined to build a weather research rocket. Soon it turned into a "multipurpose" missile.

Not quite 2 years ago, when it had long become clear that the Argentines were working on a military missile program, MBB had to cease cooperation upon pressure by Bonn. MBB engineers, which were hired by partners of the Munich company in the Condor project, remained in business—and with them the technical know-how of the Bavarians.

Insiders believe that the old Condor crew are now providing their technical knowledge to Iraq for serial production of those weapons that are developed near Mosul. Europeans report from Baghdad that a top secret production facility is currently being established somewhere in northern Iraq.

Gildemeister is able to present a clearance certificate for the dubious deals—clearance number 48422 of the Federal Economic Office.

"For presentation to the customs authorities" the Federal Economic Office attests to Gildemeister Projects Limited that "according to current rules, machinery, electrical equipment, regulation, measuring, and testing instruments for a research, development, and training institute with eight main sections, name: Project Saad 16, do not need an export permission."

The subcontractors also stress that their deliveries were legal. Peter Resz Czyski of the Hamburg Koerber AG assures that Blohm company, a member of the concern, has in now way delivered computer-controlled grinding facilities, which are subject to export permission, to Iraq. In 1985 and 1986 three standard grinding machines, type HFF 512 and Hanseat 11, "older model" (Resz czysnik) were ordered. Operators were trained for these machines in Germany and Iraq. "Everything completely harmless," Resz Czyski says.

MBB spokesman Udo Philipp also wants to give this impression. Testing centers "for surface analysis" and calibration labs were sent to Iraq. However, Philipp admits, "something like this" can "also be used for military purposes."

Gipro, too, does not want to absolutely exclude the possibility that the technology center, all of which will be handed over to Iraq "by mid-1989," could be used militarily: "In general, all universal products and facilities can often be used for several purposes."

However, what eyewitnesses have seen on site and what is proved by construction plans, goes far beyond the mere possibility of military utilization. Saad 16, located in a valley 1 km off the transit road to Sachu [spelling as published], is strictly guarded with electronics and video cameras by the military.

The more than 3.3-km-long fence is equipped with watchtowers, the main entrance is equipped with quick-action barriers. Mercedes Unimog vehicles, which are equipped with radar antennas, are patrolling between the buildings. Bungalows for managers, a first-aid station, a fire brigade, and an independent energy supply stress the isolation from outside.

Camouflage and bunkers emphasize the military character of the facility, whose center is a more than 100-meter-long hall for the construction of prototypes. In the northern part of the area a 120-meter-long subterranean shooting gallery—4 meters wide and 4 meters high—was tunneled into the mountain. The walls, insulated with noise-proof naps, look as if a chicken farm had donated its annual stock of egg cartons to this.

In a side valley to the west, there are 28 so-called resistance buildings, which have particularly stable roofs that are slanting down on one side and three stable walls, the fourth wall, on the other hand, is made only of wood. Thus, in case of laboratory accidents, the pressure of an explosion is purposefully directed into a harmless direction. Most of the 58 chemical laboratories are located there.

Adjacent, protected by walls on all sides, there is a missile test stand with control rooms and climate chambers. The buildings with measuring laboratories (from MBB), which are close by, are also protected by a 150-meter-long wall against the chemical laboratories.

Several times the speed of sound can be simulated in the 12-meter-long wind tunnels, and the 27 electronics laboratories have a nonechoing room built by Siemens.

"Only if one is inside this room," an insider says ironically, "can one overlook that this is a military project."

Companies Supply Iraqi Secret Research Center
LD0204154489 Hamburg DPA in German
1444 GMT 2 Apr 89

[Text] Hamburg (DPA)—According to the Hamburg magazine STERN, the State Prosecutor's Office and the Bielefeld customs investigations branch have begun investigations relating to the participation of German

firms in a secret military research and development center in Iraq. The magazine reports that on 20 March the offices and apartments of four managers of the company—the Bielefeld investment firm Gildemeister Projekta Co. Ltd.—responsible for the DM400 million project Saad-16, were searched and numerous documents were confiscated. This was confirmed by State Prosecutor Jost Schmiedeskamp.

In reaction to a similar report in THE WASHINGTON POST at the end of last week, the United States expressed its "great concern" about the fact that Iraq could acquire "nuclear capabilities." Citing Israeli sources, THE WASHINGTON POST had reports that Iraq was secretly working on the development of nuclear warheads for a medium-range missile that is also under development.

According to STERN a number of other German firms are involved in the affair. Among others are Messerschmidt-Boeckow-Blohm (MBB) with its subsidiary MBB Transtechnica, Siemens, and the Rheinmetall subsidiary Aviatec. The Munich company MBB, Siemens, and Rheinmetall confirmed to the magazine that they have exported to Iraq. But all the exports had been authorized by the FRG Government; permits had been issued.

The magazine report was supplied to DPA in advance.

ITALY

Nuclear Fusion Experiment To Be Repeated

AU2903092089 Rome ANSA in English
0800 GMT 29 Mar 89

[Text] (ANSA) Rome, [No date, as received]—The Italian National Alternative Energy Agency (ENEA) will repeat in its laboratory at Frascati, outside Rome, the nuclear fusion experiment recently carried out at the University of Utah, according to Scientific Research Minister Antonio Ruberti, who has discussed the project with ENEA administrators.

Ruberti said he asked ENEA to give topmost priority to the Experiment which has enormous potential as a new line of research.

For its part, ENEA announced that details of their tests would be made public as soon as possible and that the research would be done by experts in nuclear and fusion physics and electro-chemistry.

The Italian National Research Center(CNR) will also cooperate in the project.

UNITED KINGDOM

Decision on Nuclear Dumps Takes Future Into Account

51500084 London THE DAILY TELEGRAPH
in English 23 Jan 89 p 4

[Article by Roger Highfield: "Ice Age Doubt Over N-Dumps"]

[Text] Estimates of how an Ice Age could affect Britain have helped to rule out coastal sites for a nuclear waste dump.

The Government has a shrewd idea of the list of potential sites prepared by Nirex, the nuclear waste disposal authority, after receiving an interim report at the end of last year on how it rated sites.

Mr Tom McNerny, managing director of Nirex, said yesterday that the report paved the way for a short list which Nirex is expected to give the Government next month.

From the report, the Government "would certainly see the way we are going and our interest in Sellafield (Cumbria) and Caithness (Scotland) is no secret", he said.

The safety of dumps for low and intermediate level waste is being assessed far into the future. "Centuries, 10,000, a million years, that is the time-scale on which we operate," said Mr McNerny.

Nirex asked the University of east Anglia's climatic research unit to predict climates for a million years.

"Currently we are coming out of the last Ice Age and getting warmer," said Mr McNerny. "But there has been an overall dominant trend to take us back to another glaciation period."

With a warmer climate the sea level rises as ice floes melt. "Conversely, when you go into an Ice Age the sea levels fall as the ice sheets move across the country."

In glacial conditions, sea level falls of between 25 and 140 metres could have "significant implications" for repositories offshore or on the coast. The 70-metre drop shown in the map could happen in as little as 10,000 years, said Mr McNerny.

As a result, "islands will not be islands. The extra safety we get from these sites because of the dilution effect of the oceans cannot be claimed."

During a major glaciation period, ice sheets could extend to the Thames. The resulting lower sea level would "hardly affect" plans for a land repository, changing only the deep groundwater flows responsible for transporting radio-nuclides away from it, said Mr McNerny.

Only a fraction of the radioactivity initially placed in the nuclear repository would remain in 10,000 years. But in the efforts to understand how the radioactivity will spread over long periods, Nirex is interested in studies of the world's three "natural" nuclear reactors, in Africa, Australia and Canada.

The most spectacular, Oklo, in Central Africa, is where heavy concentrations of uranium 2,000 million years ago produced conditions "not unlike those found in a modern nuclear power station," said Mr Peter Curd, head of information at Nirex.

Rainwater, concentrated the uranium, triggering a nuclear reaction similar to that in a reactor. This reactor "smouldered for 500 million years to make plutonium and other products that modern reactors produce," said Mr Curd.

Scientists studying the way radio-nuclides disperse can check their findings with what happened at Oklo.

Local Officials Ask Halt to Plutonium Air Shipments

51500085 Belfast NEWS LETTER in English
20 Jan 89 p 11

[Article by Julie Stretton: "Air Halt Call to Nuke Cargo"]

[Text] Local authorities throughout Britain demanded yesterday a halt to the movement of plutonium by air until a review of safety and security is carried out.

The call came with the publication of a 164-page study analysing aircraft transportation of the radioactive nuclear component.

It was made by Ian Leitch, chairman of the national steering committee of nuclear free local authorities, which represents 177 authorities in England, Scotland and Wales.

He said: "Currently we have between 12 and 24 flights a year exporting plutonium to Europe.

"Annually we export between 300 and 500 kilograms of the material, in the main by air.

"By early 1990s when British Nuclear Fuels starts operating its reprocessing plant at Sellafield, our exports will have increased to about 4,000 kilograms a year—eight times the current figure."

The report, published yesterday, highlights the risks associated with plutonium transport by air, including concerns raised by the Lockerbie and M1 disasters.

British Nuclear Fuels said: "No transport movements will take place until well into the 1990s."

Preparations To Clean Up Windscale Debris Told

51500091 London THE DAILY TELEGRAPH
in English 16 Feb 89 p 7

[Article by Roger Highfield, Science Editor]

[Text] Engineers at the Sellafield reprocessing plant, Cumbria, are practising with a huge robot arm which will be used to clean up radioactive debris left by the West's worst nuclear accident.

A fire in 1957 at Windscale pile one, a military reactor on the Sellafield site, released a radioactive cloud.

Though the fallout was small in comparison with that ejected by the explosion at Chernobyl, the accident was a much greater threat to life than the partial meltdown at Three Mile Island in the United States.

"Without doubt, this is the most challenging decommissioning project in the UK, primarily because we are dealing with unknown conditions in the reactor," said Mr Jim Jones, of the Atomic Energy Authority.

Twenty tonnes of melted and partly-burnt fuel, out of the original complement of 180 tonnes, still lie in the centre of the No 1 reactor pile. Highly radioactive debris is scattered around.

The reactor has been sealed since the accident. The engineers are practising on a mock-up reactor for the operation, which will begin in 1991.

"We will get access through 10 in inspection holes for the manipulator," said Mr Jones.

Now that the radioactivity has dropped to about one hundredth of its original level, the first £10 million phase of the operation has started.

"You can regard the reactor like an enormous cube, 70 ft on its side inside a concrete room and separated from the walls by a 10 ft space," said Dr John Gittus, the Atomic Energy Authority's director of information.

To clear it, the authority will use a £200,000 heavy-duty manipulator designed by the Central Electricity Generating Board and manufactured by Vero Ltd.

"It is an enormous robot arm," said Dr Gittus. "Imagine a giant standing on top of this cube with an arm 60 ft long, with which he can reach down the side and pick the fuel up."

The arm will be passed down an inspection hole and used to scoop up the fuel.

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